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The Chemical Age

OL LXVIII

14 FEBRUARY 1953

No 1753

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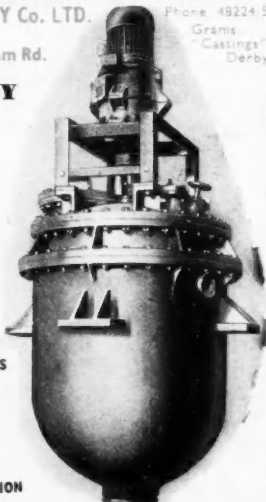
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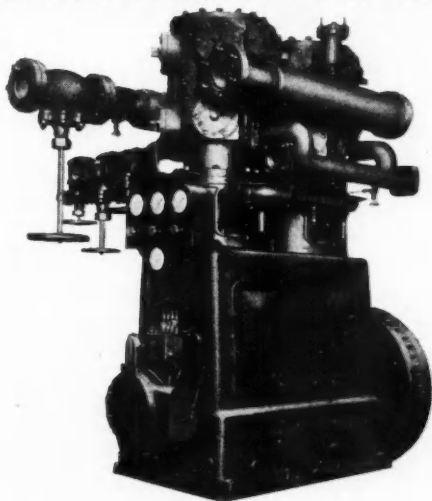
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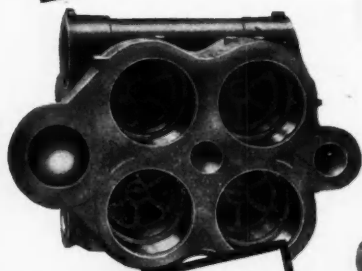


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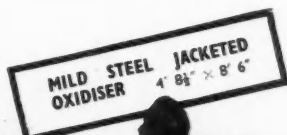
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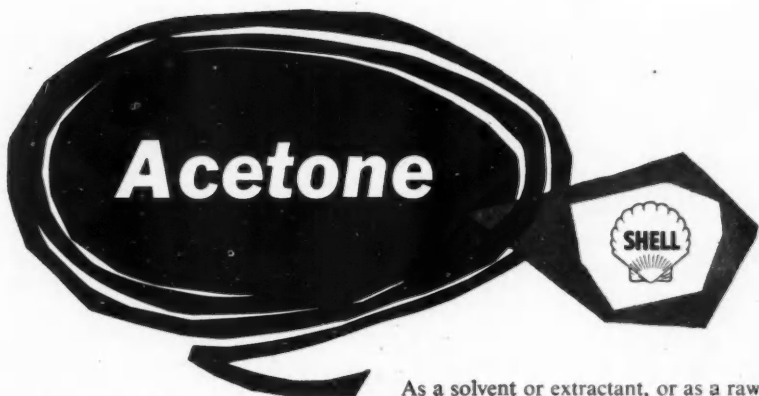
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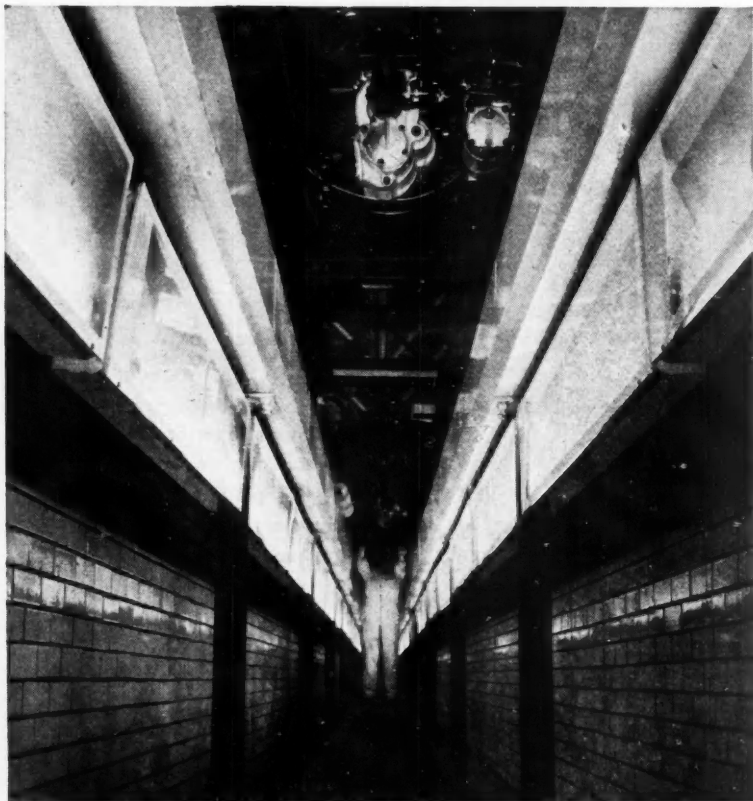
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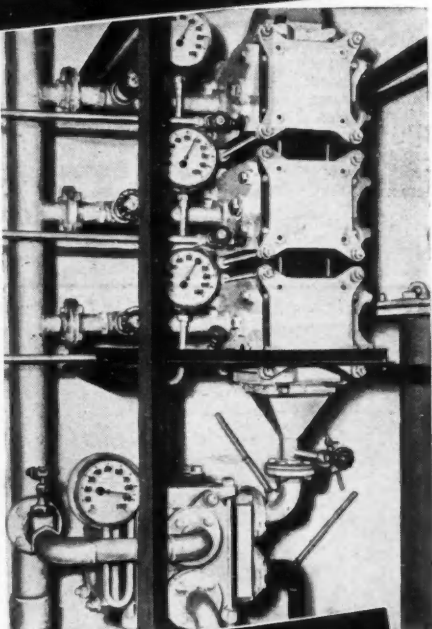
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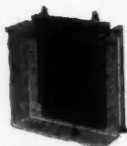


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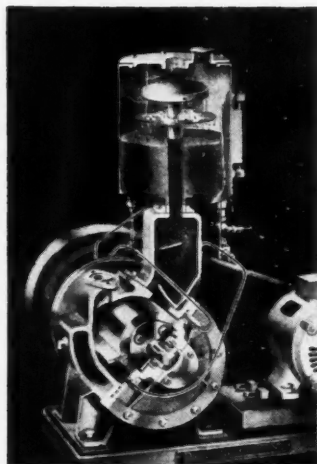
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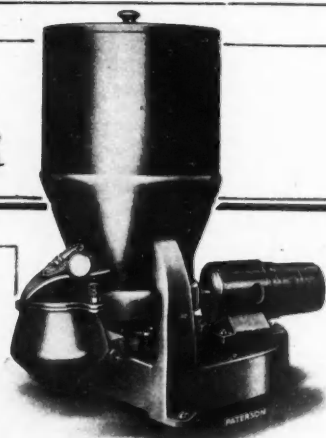
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14 February 1953

Number 1753

Brimstone & Acid

FOR prophets of gloom and disaster there is never much comfort or reward. If their predictions come true, they share in the general deluge of adversity. If not, they are contemptuously consigned to oblivion to the tune of optimists' laughter. Those who in 1950 and 1951 most strenuously warned us of the threat of sulphur shortage would now seem defeated and discredited pessimists. The crisis that was once thought imminent never quite materialised. Yet, looking back upon that period, the months when it seemed doubtful whether alternative methods for making sulphuric acid would be sufficiently brought into operation in time, it might be wise to reflect that the principal element of salvation was chance. At just that time the largest acid-using industry, fertiliser manufacture, slid into a demand-depression; as a result of price de-subsidisation farmers reduced their orders by as much as 30 per cent and far less acid was required to produce the smaller tonnage. At that time also the depression in the clothing trade was at its lowest point and the acid needs of the artificial fibres industry had dropped accordingly. Had the demands of these

two large users of acid remained at or near the level of earlier post-war years, the prophets of crisis would not now be called pessimists but realists.

In further justice to the prophets, their own efforts played a constructive part in remedying the situation. Diverse users of acid introduced economies; waste acids were put to suitable low-purity standard uses; acid production from small spent oxide and pyrites plants was stimulated. All these sulphur-saving developments together made a notable contribution, and more important still it was a rapid contribution. From mid-1951 to mid-1952 the acid supply position changed remarkably—from serious scarcity to something approaching comfortable sufficiency.

If the 'wolf' of sulphur shortage is called again, will there be an overwhelming majority of optimists replying that it was only an imaginary wolf before? An averted crisis is much less educational than one that actually happens. We were told—and not without expert authority—that the only source of cheap elemental sulphur for the world was the U.S. salt-dome mining industry, that only a few of these natural deposits could be worked, and that their sulphur could not last

more than 10-15 years at the present annual rate of consumption. If this is still true, sulphur scarcity—and in an increasingly acute form—has merely been deferred. We are told with some frequency that the American chemical industry confidently expects to expand output by 50 or 60 per cent by 1970 or 1975. This cannot be approached without large and annual increases in the use of sulphuric acid. We have no certainty that export quotas of American sulphur will always be offered to us or to any other OEEC or Commonwealth country; nor is it prudent in any case that we should have to appeal for allocations on a diplomatic or political basis. The impact of the sulphur crisis has altered the situation in America. It has been found that some of the rejected salt-domes can, in fact, be operated; at least one under-water dome is now being mined. On the opposite coastline of the Gulf of Mexico, three new and workable domes and several prospects of others have recently been located. A Mexican sulphur-mining industry as rich as that of Texas and Louisiana may eventually emerge from current explorations. The conception of a fixed and finite limit to the reserves of Frasch-minable sulphur is seen now to be a gloomy illusion; the threat of crisis in 1950 and 1951 acted as

a powerful stimulant for new and not unfruitful extensions. Nevertheless, the future sulphur demands of a 50 or 60 per cent expanded U.S. chemical industry must not be ignored. Also, all over the world growth of population leads inevitably to a greatly increased rate of fertiliser usage, and although the use of sulphuric acid can be eased or avoided the economics of the sulphuric acid process for treating rock phosphate remain as yet unchallenged—and fertilisers are economic as well as scientific commodities. Thus, though much has happened, and may still happen, to ease the sulphur situation and to improve prospects of 1960-1970 supply, ever-rising demand can easily bring back a critical equilibrium and a country such as Britain, without deposits of elemental sulphur but needing vast amounts of acid for her vital industries, cannot assume long-term security. The case for maximum development of acid production from indigenous sulphur-containing materials is as strong as it was in 1949 and 1950; so, too, where imported sulphur materials are used, is the case for a much more balanced utilisation of pyrites and U.S. sulphur. There should be no relaxation in long-term plans for sulphur-sufficiency because the time-table of sulphur scarcity has eased temporarily.

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Notes & Comments

After the Floods

THE agricultural effects of the East Coast floods cannot yet be measured. Rightly enough, most of our attention has been directed to the tragic damage and losses suffered at the various centres of population. The fact that some of our best farmland has been submerged under sea-water has seemed immediately unimportant when set against the toll of human life and homes. But it is a national blow that comes at a time when every food-productive acre is vital to our economy. What sort of soil will be left as the invading waters recede? There will be both physical and chemical damage. The physical damage—deposition of layers of silt and sand upon previously fertile top-soils—may not be general, however severe in specific places. Where the flood-water has not flowed swiftly away, the chemical damage will be much more general. It will be most serious where the soils are clay soils or loams with an appreciable clay content. Sodium, useful though it is as a direct plant nutrient for a number of crops, is a villain in excess. The workable type of clay becomes unworkable when sodium heavily displaces other cations in the clay complexes. Also, when sodium is over-abundantly present in top-soils, the excessive uptake of this element by crops that do not need much sodium is likely to reduce the uptake of other more important elements, e.g. calcium.

Chemistry Can Help

IT has been said that the natural recovery of soils from serious sea-water flooding takes six or seven years; but this period can be appreciably shortened by chemical means. In Holland much of the farmland flooded by the German Army before its final retreat upon Berlin was again in production in two years. An essential step in reclamation of fertility was heavy treatment with gypsum or calcium sulphate, which reconverted sodium clay complexes into

the much more desirable calcium clay complexes. If the flood problems of Holland were not so much more catastrophic than our own, agricultural experts from the Netherlands would be of inestimable service to us in the next few months; but the recovery problems facing the Dutch farmers will absorb every minute their soil scientists can give. The benefits we can derive from their great experience will almost certainly have to be indirect; and from what is already known about the methods used after the last war, we can assume that there will be a substantial demand for calcium sulphate in suitable condition for spreading on the land. Later there will be an intensified demand for fertilisers, but the inability to sow many flood-affected acres this spring is likely to reduce immediate fertiliser demand.

'Productivity'

IN our recent leader on the Heavy Chemicals Anglo-American Productivity Report (issue of 24 January) we mentioned the various U.K.-U.S.A. ratios of productivity that were revealed when sulphur processes for sulphuric acid in the two countries were compared. Indeed, no report or publication that has come our way has provided a sharper example of the dependence of this modern word 'productivity' upon terms of reference. Productivity per man-hour, or per man-year, or per unit amount of capital invested, or measured as added value per employee or as sales value per employee—all these are different measures of productivity, and from the comparison of the same two factories performing similar work five different ratios of productivity comparison could emerge. Many well-informed people with a taste for modern economic lore will merely say, 'So what?' But others may agree with us that in the modern and widespread use of the word 'productivity' the yardstick by which it is measured is rarely discussed. It is an attractive word that has slithered into ambiguity, the all

too common fate of words that are over-worked in their adolescence. We thought that a firm ruling on the proper meaning of 'productivity' might be found in the First (1949) Report of the Committee on Industrial Productivity. Our hopes were not fully rewarded. 'The term productivity itself requires some discussion. It is often measured by the volume of output of a worker in a year, in terms of goods or services . . . For some purposes, however, output per man-hour is used as the measure of productivity . . . In the present circumstances it is desirable not only to accelerate improvements in output per man-hour, but also to secure that they are fully reflected in an increase in output per man-year. We have used the term "productivity" in this latter sense.'

Useful Measures

WHEN it is considered how frequently newspaper reports tell us that productivity in this or that industry has increased or fallen back, the danger of this word's uncertainty will be more clearly appreciated. An installation of machinery may raise productivity per man-hour or per man-year. The machinery, however, may have cost a sufficient capital sum to nullify any

increase in productivity measured by output per £10,000 of investment. A factory with predominantly old plant may show no change in productivity per man-year, but when allowance is properly made for plant value depreciation productivity measured by investment has risen. For the chemical industry the measures of productivity that surely serve the most useful purposes are those of 'added value per employee' (with employee preferably regarded in man-year units) and 'output per unit of capital investment.' In comparison with other great industries, the chemical industry's man-power demands are not large; the potentialities of 'adding value' to cheap raw materials are large, however, and so too are the requirements for new capital, whether ploughed back or obtained by investment. A few years ago capital seemed cheap and plentiful and man-hours were a short-supply commodity. Capital is no longer cheap and plentiful, and man-hours, though still in short supply, are not quite as scarce. In plans for the chemical industry's future, especially for the part it can play in improving the national economy, it seems highly important to talk about, and chase improvements in, the right kinds of productivity.

Study Being Made

THE Member for Edmonton, Mr. A. Albu, last week asked the Parliamentary Secretary to the Ministry of Works, as representing the Lord President of the Council, what action had been taken arising out of the Report of the Committee on Chemical Engineering Research. Mr. Molson replied that the Advisory Council for Scientific and Industrial Research had considered the Committee's Report and had agreed that a central research organisation was needed. Representative industrial bodies had been consulted and were now making a more detailed survey of the information available in industry and the resources in industry for further research. Until this survey was completed it would not be known whether industry would set up its own research organisation or whether some other means of meeting the requirements for research in this field would have to be found.

Mond Nickel Fellowships

THE Mond Nickel Fellowships Committee has announced that it is ready to consider applications for fellowships of an approximate value of £900 to £1,200 for 1953. Fellowships will be awarded to selected candidates of British nationality with degree or equivalent qualifications to enable them to obtain wider experience and additional training in industrial establishments, at home or abroad, to make them more suitable for future employment in senior technical and administrative positions in British metallurgical industries. Each fellowship will cover one full working year. Applicants will be required to state details of the programme they wish to carry out. Particulars and forms of application are available from: The Secretary, Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London, S.W.1. Completed application forms are required by 1 June, 1953.

The Theory of the Kachkaroff Sulphuric Acid Process

by SVEN NORDENGREN*

THE processes for the production of sulphuric acid in lead chambers or towers have practically been developed without any exact knowledge of the chemical reactions leading to the formation of sulphuric acid. Up to about 1925 the theory of Lunge for the lead chamber process was generally believed. According to this theory, the sulphuric acid was formed in the gaseous phase of the lead chambers, a hypothetical compound, SO_2NH_2 , called 'sulphonitronic acid,' identified as the blue or purple acid sometimes seen as a colouring of the chamber acids, being regarded as the primarily formed compound from which sulphuric acid was derived.

In the middle of the twenties it was found that the main reactions, by which sulphuric acid was formed in the lead chambers, took place in the liquid phase; that the sulphur dioxide consequently had to be absorbed in the liquids present; that those liquids mainly consisted of sulphuric acid of varied concentrations containing nitrosylsulphuric acid in solution; that this nitrosylsulphuric acid, SO_2NH , was, according to temperature and concentration of the sulphuric acid, more or less hydrolysed into sulphuric acid and nitrous acid; that the nitrous acid in turn was partly decomposed into various nitrogen compounds staying in the solution; and finally that the reactions forming these compounds, nitrous acid included, were equilibrium reactions. From a paper by the author publishing the results of these investigations the following may be quoted:

'Nitrosylsulphuric acid will always be hydrolysed (to a certain extent) into sulphuric acid and nitrous acid; nitrous acid will be decomposed into N_2O_3 and water; N_2O_3 into NO and NO_2 ; the latter compound will form N_2O_4 , which oxide with strong sulphuric acid will form an equilibrium with nitrosylsulphuric acid and nitric acid. In this way all compounds mentioned will be present in a solution of nitrosylsulphuric acid in sulphuric acid, although, owing to the small grade of hydrolysis possible, only in very small quantities. All reactions being equilibrium reactions, the bringing in of a reductive such as SO_2 will cause a disturbance of all these equilibrium reactions.'

This still left open the question of the main sulphuric acid-forming reaction. Other investigators made it clear that SO_2 in solution acted as H_2SO_3 . There would be a possibility of this compound reacting with HNO_2 itself or with N_2O_3 , NO_2 , N_2O_4 , or even with HNO_3 , small quantities of all these compounds being likely to be present in a partly hydrolysed solution of nitrosylsulphuric acid. No one suggested that the sulphurous acid would react with undecomposed nitrosylsulphuric acid, which would be contradictory to the fact that the oxidation process reaches its maximum when the nitrosulphuric acid is completely decomposed by hydrolysis.²

Further investigations showed the likelihood of nitrous acid itself being the main although not only the oxidiser. It had been known for a long time that if SO_2 was led into an aqueous solution of HNO_2 it was oxidised and the nitrogen compounds partly reduced to N_2O . It was now shown that H_2SO_3 might react with HNO_2 in two ways: either reducing the nitrogen compounds to NO or to N_2O . It all depends on whether there is a surplus of HNO_2 or of H_2SO_3 .³

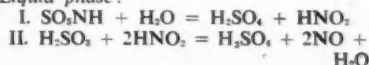
The reason given is the following. In the first part of the reaction a radical HNO , called 'nitroxyl,' is being formed:

- a/ $\text{H}_2\text{SO}_3 + \text{HNO}_2 = \text{H}_2\text{SO}_4 + \text{HNO}$;
With a surplus of nitrous acid NO is formed:
- b/ $\text{HNO} + \text{HNO}_2 = \text{H}_2\text{O} + 2\text{NO}$;
but with a surplus of H_2SO_3 two 'nitroxyl' radicals will form N_2O :
- c/ $2\text{HNO} = \text{H}_2\text{O} + \text{N}_2\text{O}$;

At the concentrations of the Lead Chamber Process there is a surplus of HNO_2 in the solutions, and the reaction, at least normally, will proceed according to reaction b.

It is generally believed to-day that the main reactions of the Lead Chamber Process are as follows:

Liquid phase:



* Landskrona, Sweden.

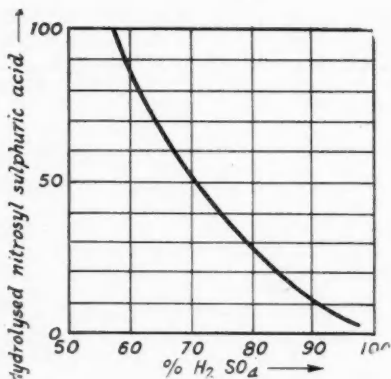
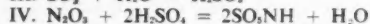
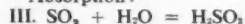


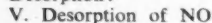
Fig. 1. Hydrolysis of 0.1 m nitrosyl-sulphuric acid solved in sulphuric acid of varying concentration

Liquid to gaseous phase:

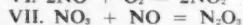
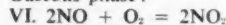
Absorption:



Desorption:



Gaseous phase:



The development of the Hugo Petersen tower units has greatly facilitated the understanding of the Lead Chamber Process.

The latest development in the manufacture of sulphuric acid with the aid of nitrogen compounds is the Kachkaroff Process. Its inventor, and later his followers, Guareschi in Italy and Salsas Serra in France, claim that the process itself is entirely new; that it is not a modification of the Lead Chamber Process as the Petersen process but that it is founded on facts hitherto unknown regarding the binding and unbinding of nitrogen compounds.

A new process for the making of sulphuric acid, founded on reactions yet unknown to science would be of the greatest interest not only to the sulphuric acid industry but also to science itself. Therefore, the theories and suppositions of the inventors should be put to test in the light of recent investigations and studies, with a view of finding out whether there is a probability of a new process, or if it is likely that the results obtained in the Kachkaroff plants can be explained

with the aid of our present knowledge.

At the technical meeting of the International Superphosphate Manufacturers' Association held in Paris during September, 1951, Mr. Salsas Serra presented an interesting paper on the development and evolution of the Kachkaroff process. The apparatus consists of one or two Glover towers, placed in series or parallel, three to five reaction towers and two Gay-Lussac towers. There is an outer and an inner circulation of acids. The cooled Glover acid goes to the last Gay-Lussac tower, from there to the first Gay-Lussac, and the nitrous sulphuric acid thus produced is de-nitrated on the first Glover tower. There is an inner circulation of nitrous sulphuric acid over the production towers which are partly packed with Raschig rings and have centrifugal atomisers to distribute the acid. The surplus of this acid is de-nitrated on the second Glover tower.

There is nothing specially new in these arrangements. A Kachkaroff plant will differ from a Petersen plant only in details or choice of materials.

The only difference of importance seems to be that the acids circulating over the production towers of a Kachkaroff plant are stronger than those of a Petersen plant, 61-64°Bé instead of 59-60°Bé. They have a nitrogen content corresponding to 5-10 per cent N_2O_3 which is considerably more than in the Petersen plants.

High Content Understandable

This high nitrogen content is quite understandable. Only the hydrolysed part of the nitrosylsulphuric acid is acted upon by the sulphurous acid according to formula I. Fig. 1 shows a diagram of the hydrolysis of 0.1 m. nitrosylsulphuric acid in sulphuric acid of varying concentration.⁴ In order to obtain a constant quantity of 'free' nitrous acid, it will be necessary to increase the total nitrogen content with rising concentration of the sulphuric acid, as the hydrolysis is decreasing with increased concentration.

Salsas Serra now claims that the formation of sulphuric acid at such high concentrations depends on a compound hitherto unknown which is said to have a pronounced oxidising power. This will enable a much higher production per tower volume than in other tower plants such as the Petersen plants.

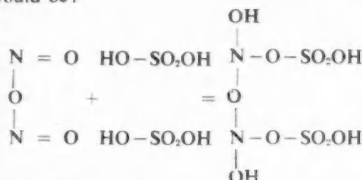
Calculated on the total tower volume, a Petersen unit will produce about 30 kilos of

100 per cent sulphuric acid per 1 cubic metre in 24 hours, with a very small loss of nitrogen, only 0.3 to 0.5 per cent 100 per cent HNO_3 . According to Salsas Serra, a Kachkaroff plant would be able to produce about the double quantity with a loss of 1 per cent. As far as the author knows no proof has been given confirming this statement.

The compound which, hitherto unknown, is said to have an extreme oxidising power, is called by Salsas Serra 'hydrated nitrosylsulphuric acid' and supposed to be formed as follows:



Written in extended form the equation would be:



The existence of a compound with this composition is highly improbable. In the following the reasons of this opinion will be given.

1. We know that the formula of the lead chamber crystals is SO_3NH . Solid crystals are formed when SO_3 reacts on concentrated nitric acid:



This compound should be regarded as $\text{ONO}\cdot\text{SO}_3\cdot\text{OH}$.

Insufficient Water

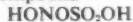
There is not enough water present in concentrated nitric acid to form $(\text{SO}_3\text{NH})_2 \cdot \text{H}_2\text{O}$. We know that a solution of lead chamber crystals in sulphuric acid reacts exactly as nitrous sulphuric acid. It might perhaps be said that the compound $(\text{SO}_3\text{NH})_2 \cdot \text{H}_2\text{O}$ could be formed when lead chamber crystals are dissolved in sulphuric acid of certain density. This would necessitate a reaction between SO_3NH and water which is not very likely to occur:



As far as the author knows there is no example of a water molecule being split up in this fashion, sending its three atoms in

different directions. What generally happens when water is added to a compound is that it is either added undivided as a hydrate or is split up in $\text{H} + \text{OH}$.

2. If a compound



has a special oxidising effect, it must be caused by the oxygen atom. The oxidation will then be due to the reaction:



We are then actually back to the hypothetical compound of Lunge called 'sulphonitronic acid,' the existence of which has never been proved.

3. If a compound $(\text{SO}_3\text{NH})_2 \cdot \text{H}_2\text{O}$ were formed, some signs ought to be found in the diagrams showing the speed of reaction between N_2O_3 and sulphuric acid of varying density. This reaction speed has been studied*. The result is shown in Fig. 2, which also gives the reaction speed of NO_2 (N_2O_4).

There is a strong resemblance between the reaction diagrams of N_2O_3 and of N_2O_4 . Both fall to a minimum, from there to rise evenly with the increasing concentration of the sulphuric acid, although the minimum of the N_2O_3 reaction lies at about 18 per cent sulphuric acid and the minimum of the N_2O_4

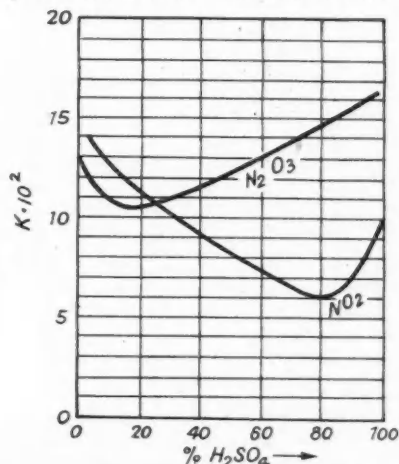


Fig. 2. Speed of absorption of N_2O_3 and NO_2 in sulphuric acid

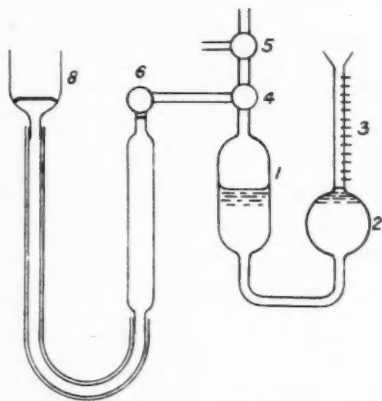


Fig. 3. Apparatus for the determination of relative reaction speed between SO_2 and nitrous sulphuric acid

reaction at about 82 per cent. In both cases the diagrams indicate that two reactions have taken place, the one undoubtedly with water and the other with sulphuric acid:



The reactions of $\text{NO}_2(\text{N}_2\text{O}_4)$ will be:



There is nothing in the diagram of N_2O_5 indicating that another reaction sets in at a concentration of about 80-86 per cent, which is the concentration of sulphuric acid used in the Kachkaroff plants.

There seems to be no doubt whatever that a compound $\text{SO}_3\text{NH}_2 \cdot \text{O} \cdot \text{SO}_3\text{NH}_2$ does not exist.

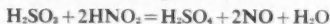
There would be a possibility that, at certain concentrations, water was added to the nitrosylsulphuric acid as a hydrate, $\text{SO}_3\text{NH}(\text{H}_2\text{O})_x$. It has, however, been found that no such hydrates are formed.

If the 'hydrated nitrosylsulphuric acid' does not exist, there would be no proofs of the existence of a special process forming sulphuric acid at concentrations between 61° and 64° Bé (80-86 per cent). It is, in fact, not very likely that sulphuric acid should be formed by two different processes, one above 61° Bé and the other at lower concentrations.

The increasing number of Kachkaroff plants being built in Italy and France necessi-

tates a definite answer to the question if there is a higher production in such plants per cubic metre although there seems to be no theoretical explanation to such a fact. In order to investigate this the author made the following tests.

A vessel (1-Fig. 3) was filled with nitrous sulphuric acid of various concentrations, the quantity of nitrosylsulphuric acid so determined that always exactly the same quantity of 'free' HNO_2 was present. A quantity of SO_2 -gas was sucked into the vessel reacting with the nitrous sulphuric acid:



One volume of SO_2 transformed to sulphuric acid liberates two volumes of NO and the increased gas volume can be noted on the graduated glass tube marked 3. The small errors due to the solubility of SO_2 and NO in the acids are calculated not to influence the results.

The following nitrous sulphuric acids were used (parts by weight):

	I	II	III	IV
H_2SO_4	75	78	80	85
H_2O	25	22	20	15
'Free' HNO_2	1.6	1.6	1.6	1.6
Unhydrolysed SO_3NH	6.7	8.9	11.2	18.8

The results will be seen in Fig. 4. With a constant quantity of 'free' HNO_2 present

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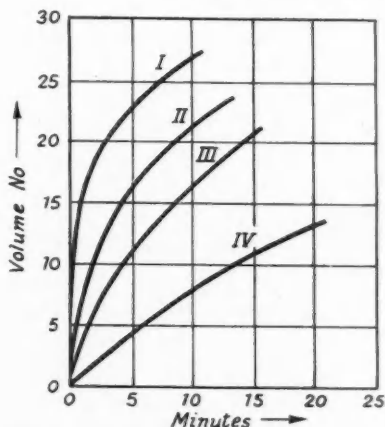


Fig. 4. Relative speed of reaction between SO_2 and nitrous sulphuric acid I-IV

Exploitation of Inventions

3rd Report of the NRDC

WORK of the National Research Development Corporation and examples of projects selected for development are described in the report accompanying the statement of accounts for the year 1 July, 1951-30 June, 1952, published by HMSO (9d.).

While previous reports have been largely devoted to describing the administrative aspect and policy of the corporation this, its third report, is more concerned with work which is now being carried out.

A proposal from the Imperial College of Science and Technology for development in the field of hydrocarbon synthesis seemed to be of sufficient interest to warrant assisting it at public expense. The corporation is therefore supporting experimental work for materials and the employment of personnel.

Cortisone occurs in such minute quantities in the adrenal glands of men and animals that no process for its extraction from them is ever likely to be of more than academic interest.

Studies at the National Institute for Medical Research have led to the discovery that hecogenin derived from sisal juice, a waste product from the commercial processing of the sisal plant for the production of fibre, is a potential starting material.

Sponsoring Pilot Plant

The corporation is therefore sponsoring a pilot plant in East Africa based on a laboratory unit set up under the joint auspices of the Medical Research Council and the East African Industrial Research Board to act as a centre for more extended study of methods of extracting and processing sisal juice for hecogenin production.

Arrangements are being made with a well-known commercial firm to install and operate the plant under contract and also with the East African Industrial Research Board to provide the necessary degree of control and supervision.

Inventions communicated to the corporation during the period under review totalled 1,027 comprised as follows:—Government Departments and Research Councils, 491;

universities, 53; Commonwealth Official organisations, 16; industrial research associations, eight; charitable organisations, three; nationalised industries, one; private firms and individuals, 432 British, six Commonwealth and 17 foreign.

Patent rights and inventions assigned to the corporation during 1951-52 totalled 445 of which 414 were from Government Departments and Research Councils 22 from universities; three from industrial research organisations; two from Commonwealth Official Organisations; one charitable organisations and three from private firms and individuals.

Since its formation three years ago 1,736 patents and patent applications have been vested in the corporation.

No new financial sponsorship during the period under review was provided for the development of inventions from private individuals unconnected with industry. Some submissions made during the year are, however, still being studied.

The Kachkaroff Process

continued from opposite page

the reaction will be slower with increased concentration of the sulphuric acid, which was to be expected as the solubility of SO_2 in sulphuric acid has its minimum at about 85 per cent H_2SO_4 .

Nothing in these tests indicates a special process. There is only one process, the Lead Chamber Process, and Kachkaroff and Petersen plants both use this process. There may be small differences in the technical arrangements, in the cooling of acids and so on, by which certain differences in the production per cubic metre can be explained, but fundamentally the Kachkaroff and Petersen tower 'processes' are identical.

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- ¹ Sven Nordgren, *Teknisk Tidskrift*, Stockholm, allm. avd., 1925, p. 189.
- ² Berl, Hillebrandt and Winnacker, *Z. anorg. u. allg. Chem.*, **214**, 369 (1933).
- ³ E. Abel and Proisl, *Sitz. ber. der Wiener Akad.*, **144**, 11 b 138 (1935) and **146**, 11 b 201 (1937).
- ⁴ Diagram drawn by Stevinius-Nielsen after Hantzsch and Berger, *Z. anorg. u. allg. Chem.*, **190**, 321 (1930).
- ⁵ Hantzsch and Berger, *Z. anorg. u. allg. Chem.*, **190**, 321 (1930).
- ⁶ Szego, Molaguti and Lombardi, *Giorn. chim. ind. appl.*, **14**, p. 12, and 492 (1932) and **15**, p. 189 (1933).
- ⁷ Hantzsch and Berger, *loc. cit.*

Development of the Diesel Engine

New Equipment Helps Meet Increased Industrial Demand

INCREASING demand for diesel engines for private generation and other applications in industry is reflected in the success of the enterprising expansion and development policy achieved by Mirrlees, Bickerton & Day Ltd., of Stockport, one of the Brush Abco group of companies. Orders in hand are valued at a total of more than £12,000,000, which at the present rate of production is equal to two years' work. Some of these, however, are not required until 1955, so that certain orders can still be accepted for delivery next year.

Field Considerably Extended

The field of potential business has been considerably extended by the new 'J' and 'K' type engines due to the fact that the power range has been more than doubled (previous maximum output—1,320 BHP against the present 3,000 BHP), and the much wider speed range permitted by the shorter stroke 'J' engine has made it suitable for more numerous applications.

An interesting development in the home market has been the increased demand for private generation by the textile industry. This has been encouraged by the fact that all textile mills require low pressure steam or hot feed water, and as a result can make full use of all exhaust heat by means of exhaust heat boilers. Some mills fitted with Mirrlees engines claim an overall efficiency of up to 80 per cent. A special textile division has been established to concentrate on this particular industry.

The site of the present factory was first occupied in 1908, when Mr. Charles Day who had built up the Mirrlees Watson business in diesel engines joined forces with Mr. Henry Nield Bickerton, founder of the National Gas and Oil Engine Co., Ltd., of Ashton-under-Lyne, and the present company was formed.

The area now covered by the Hazel Grove works is approximately 300,000 sq. ft. of which over one-third has been added since 1946. Improvements in production have been constant and particularly vigorous during the last four years, in which period 95 per

cent of the machine tools and equipment have been renewed at a cost of £400,000.

New equipment added recently includes four Plano milling machines, which do the work in half the time of the old standard planers; an Asquith double-head angle borer (for liner bores) which ensures greater accuracy and bores the main housing for cylinder liners at an all-in average rate of 90 minutes per cylinder—this machine was designed to deal with both in-line and vee-type engines; an Alfing bedplate borer which, due to greater accuracy, saves a great deal of time in the erection shops in connection with the fitting of main bearings; and a Fischer profile turning lathe for the machining of the special through-bolts required on the 'K' engines.

Among the instruments used for various purposes are a Firth-Brown Hardometer test-hardening machine, a Hilger and Watts 'Microptic' colorimeter and a Hilger T.500 universal measuring projector for checking the British Standard Whitworth thread.

Water Resources Map

A MAP showing the water resources in Scotland for the guidance of chemical firms and others is being prepared by the Scottish Council (Development and Industry) in collaboration with the Department of Health in Scotland.

In an article in the February issue of the Scottish Council's magazine, Dr. T. Sheddon explains that the Council has been dealing with requests from chemical firms in Britain and America for information about sites and facilities suitable for chemical plants. Cases dealt with have ranged from an inquiry for a 30-acre site with water supply of 1,000,000 gallons a day to one for a site of 1,000 acres and a water supply of 20,000,000 gallons a day. While almost all the underground sources in England are over-pumped, Scotland has abundant sources of pure water. The need of the new and developing chemical industries for water is so great that this determines the siting of works.

The Kestnamine Carbon Dioxide Plant

Economical Output from Fuel Oil Process

A MAJOR development in the chemical plant field took place recently with the production of a range of small, compact, highly-efficient plants in the production of liquid carbon dioxide by means of controlled combustion of fuel oil. The process is known as the Kestnamine process and the plants are designed and manufactured by Kestner Evaporator & Engineering Co., Ltd., Grosvenor Gardens, London, S.W.1

Plants currently being produced (for use in less-highly-developed countries where large-scale CO₂ production is impractical or impossible) have outputs of 100 or 200 pounds per hour. By means of a relatively simple addition the liquid CO₂ can be converted to dry ice for use as a refrigerant.

A good quality mineral fuel oil (preferably desulphurised) is burned with minimum excess air in the furnace of the lye heater by means of a special proportioning oil burner capable of producing a flue gas approaching the theoretical CO₂ concentration—viz. 15 per cent v/v. Oil from the main storage tank is fed to the small holding-tank supplied with the plant and which is fitted with a level gauge glass. A motor-driven fuel oil pump is provided along with an electric oil heater for use with heavy fuel oils having a viscosity of the order of 200 seconds Redwood 1. at 100°F.

Provision of Combustion Air

Combustion air for the burner is provided

under pressure by means of the air blower which is of the motor-driven rotary positive displacement type, which also serves to drive the combustion gases through the raw gas side of the plant.

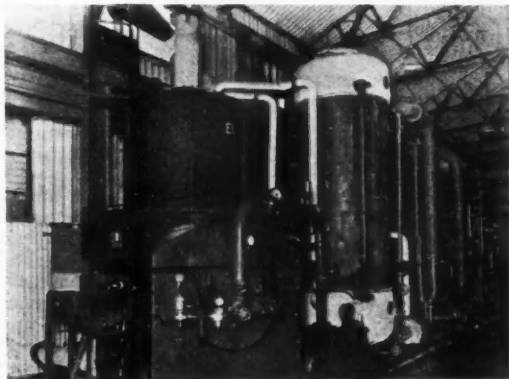
The production of high-CO₂ combustion gases is associated with very high flame temperature within the furnace and this, in turn, enables a high proportion of the heat of combustion to be transmitted to the lye circulated through the heating coil in the upper section of the lye heater.

Partially cooled flue gases from the top of the furnace then pass to a direct contact water spray cooler. The quantity of cooling water supplied to this item should be adjusted to give an exit flue gas temperature of 45°C.

The cooled flue gases pass to the SO₂ scrubber in which acidic sulphur gases are absorbed by means of a 10 per cent solution of sodium carbonate in water, which is circulated by means of a pump from the base of the scrubber to the three spray nozzles.

The cooled, scrubbed flue gases pass through two absorption towers where they meet the aqueous amine absorbent lye. This lye absorbs most of the CO₂ from the flue gas which is discharged to atmosphere from the branch at the top of the second absorption tower. The rejected gases from the raw gas circuit consist mainly of nitrogen with a little CO₂ saturated with water vapour.

A Kestnamine CO₂ plant in production at Kestner's factory, New Cross, London. The plant, which is built on four steel rafts of approximately equal size, has since been dismantled and shipped to Siam



Cool stripped lye enters the top of the second absorption tower and after partial enrichment is pumped from the base of this vessel by means of a pump to the top of the first absorption tower. Enrichment of the lye is completed here and the rich lye from the base of this unit is transferred by means of a pump to the heat exchanger. The temperature of both gas and liquid in the absorption section is maintained at about 45°C.

The cool rich lye in the heat exchanger receives heat from hot stripped lye leaving the stripper, and passes to the top of the stripper at a temperature of about 120°C. The stripper is a ring packed tower generally similar to the absorption towers, and as the lye passes down this section it meets a current of steam which strips from the rich lye the CO₂ absorbed in the absorption section. This stripping steam is generated by the circulation of stripped lye from the base of the stripper through the heating coil in the top section of the lye heater.

Stripped hot lye leaves the bottom of the stripper and passes through a level control chamber. If the level in the stripper and hence the chamber should fall—due for example to cessation of flow of lye to the stripper from the heat exchanger—the float

valve in the chamber opens allowing lye to flow from an annular buffer storage vessel, thus safeguarding the lye heating circuit.

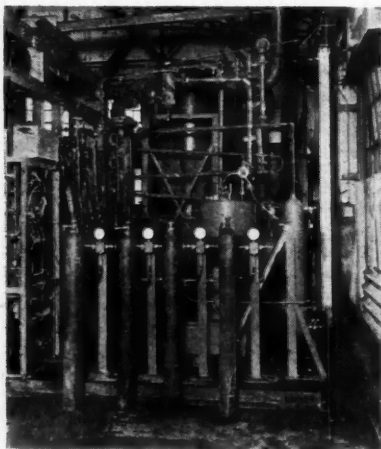
The stripping section is operated under a positive pressure of (normally) 40 p.s.i.g. This serves to force the hot stripped lye through the heat exchanger and cooler to the top of the second absorption tower without the necessity of a separate pump.

From the level control tank the hot stripped lye passes through the heat exchanger where it gives up most of its heat to the incoming rich lye and then through the lye cooler where it is cooled to 45°C. by interchange with cooling water. This cooled stripped lye is then returned to the top of the second absorption tower for a fresh absorption and stripping cycle.

The CO₂ stripped from the rich lye, accompanied by a proportion of stripping steam, passes to the CO₂ cooler where the steam is condensed out and the CO₂ cooled to as low a temperature as can be achieved by the cooling water available. The condensate is then separated from the gas and returned to the base of the second absorption tower (in order to maintain the working concentration of the lye) by means of a condensate trap.

The CO₂ from the separator after the CO₂ cooler passes through both sections of the rich gas purifier, which contains a solution of alkaline permanganate. The object of this item is to remove taste-and-smell-producing traces from the gas and a system of pipe-work and valves is provided to facilitate replacement of the solution during the operation.

The purified CO₂ then passes to the suction of the compressor which compresses the gas to the usual bottle filling pressure of up to 1,800 p.s.i.g. The compressed CO₂ then passes first to a separator where moisture and any glycerine carried over from the compressor are collected and then to high-pressure purifiers and driers which contain activated carbon and activated alumina respectively for the final purification of the gas. From these vessels the gas then passes to the four-point cylinder charging header to which the CO₂ cylinders are connected. During filling the cylinders are supported on spring balances which enable the operator to determine when each cylinder has been charged with the correct weight of CO₂.



A Kestnamine CO₂ plant showing the charging header to which the gas cylinders are connected

MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

The Analyst & Electroplating

THE January meeting of the Midlands Society for Analytical Chemistry was held in the Mason Theatre of the University, Edmund Street, Birmingham, when the subject under discussion was 'The Role of the Analyst in the Electroplating Industry.' This topic was introduced by Mr. K. E. Langford, A.R.I.C., A.I.M., chief chemist of Messrs. Evered & Co., Smethwick, and lecturer in electrodeposition at the College of Technology, Birmingham. Mr. Langford has recently published a book on plating control and has a first-hand experience of the plating industry in the Midlands. His paper and the subsequent discussion follows:—

To survey the whole electroplating industry and give some account of the many problems which arise in plating processes may result in too long a discussion, but it is evident that some attention must be paid to the structural organisation of this industry if its problems are to be appreciated. The industry itself is not a very large one but is composed of very small firms, employing only a few persons. Many of these firms are simply jobbing platers who will accept any type of article for plating; they are not specialist platers as a general rule.

Own Plating Shops

Many industrial concerns find it more satisfactory to have their own plating shops where plating is confined solely to the products manufactured by the company. As a rule, these firms can afford to have a plating chemist to look after these plating shops, whereas the small jobbing platers rely on their own empirical experiences to overcome the oft-arising problems. The industry is a highly competitive one with very much undercutting of prices by rival companies. Unless he can justify his existence, there is no room for a plating chemist in these concerns. The staff employed in the industry is very heterogeneous and varies often from a highly qualified chemist to the plain labourer. Specific qualifications for platers are in existence; the City and Guilds' Certificate can be obtained by examination, but, unfortunately, this carries little weight in the trade and the attraction for young people to

follow the electroplating craft is very slight.

It is almost twenty years since the chemist entered the plating industry, although the effect of chemical methods is still only obvious in the larger concerns which can afford the services of a chemist. The smaller firms are still carrying on with their time-honoured empiricism and these firms are often characterised by a secretive and suspicious mentality born of the highly competitive Victorian era.

The Chemist's Duties

Since the jobbing platers are usually not concerned with chemists, most of the remarks on the duties of the plating chemist must be confined to those employed by the larger organisations. The main duties of a chemist in such organisations are (1) maintenance of production quality, (2) improvement and development of new processes, and (3) research. In this country research requires money which the plating industry appears unwilling to provide. Only very large firms can afford the luxury of a research laboratory and, even then, the research is seldom of a fundamental nature. Most fundamental research stems from American laboratories; in this country it is negligibly small. Much of the applied research is carried out by the supply houses, that is, the firms which supply the materials for the plating industry. Such research, based on commercialisation of the supply house products, is often capricious and results in fierce competition for the sale of plating solutions. One firm may recommend the replacement of thousands of gallons of plating solutions with their own solutions and unless such practices can be controlled, the industry must undoubtedly suffer.

The improvement of new processes depends largely on the type of firm engaged on this aspect. A great deal depends on the ability and even the good luck of the persons concerned; in general owing to the relatively small cost only the smaller firms are interested in the improvement of existing processes and their results are kept as trade secrets. The development of new processes is found in the larger firms where

there are laboratory facilities for the plating chemist. The results of laboratory experiments are then applied on a works scale. It is an entirely different business, however, to carry out plating experiments in small pots and in full-scale production vats carrying many articles to be plated. Such development calls for the acquirement of the American 'know-how' and depends largely on the experience of the plating chemist.

Analytical Aspects

The analytical aspects of the plating industry arise in all three of the divisions mentioned above. Analytical control is most important in the maintenance of production quality; this may be further subdivided into the following:—

- (a) Control of plating solutions by analysis.
- (b) Control of anode material as provided by supply houses.
- (c) Control of water used in process work.
- (d) Thickness testing of plated films.
- (e) Electrical control.
- (f) Checking composition of trade products (salts and other compositions, etc.).

Divisions (b) to (f) may be disposed of by brief discussion. Anode materials are usually of good quality since the supply houses cannot afford to lose trade by supplying faulty or impure anodes. However, the occasion often arises where analysis of the anode material is essential; during a recent nickel shortage, anodes of nickel were found to contain up to 8 per cent of copper which resulted in the complete ruination of nickel-plating vats. Careful control is necessary under such circumstances.

For years untreated water has been used in plating processes without undue concern. It is often advantageous to treat very hard water before using in plating vats (as manufacturers of water softeners are at such pains to point out). Satisfactory surfaces are determined by established thickness tests. The British Non-Ferrous Metals Research Association employs a jet-test apparatus for measuring the thickness of plated coatings; in this test, the time taken by a jet of an appropriate solution which impinges at constant pressure at any desired point on a plated article measures the thickness of the coating at that point. The Air Ministry adopted this test during the war as a standard method for the determination of

the thickness of coating of plated articles. [The B.N.F. jet-test apparatus is available commercially.]

In the plating industry, the chemist must have a wide knowledge of electricity, especially when things go wrong. It is customary for the workers on the job to put the blame for everything on the solution, whereas, in actual fact, most hold-ups are caused by failures in the electrical circuits. Ability to trace and correct these electrical breakdowns is the duty of the chemist in charge of the plating shops. The checking of trade products, such as salts and plating salt compositions is necessary only as a safeguard. Reliable supply houses are careful in controlling the purity of their products, but occasional checking by the plating chemist is another of his duties.

The most important analytical procedures arise in the control of the plating solutions. Such control is a routine job and is effected daily, weekly, monthly or often yearly on certain constituents or certain types of plating vat solutions. This routine control is essential as it avoids trouble in the plating shops. The plating solution must always be correct; there is no margin of error in this aspect of the plating industry. New plating solutions are often developed by the larger firms, and this necessitates the introduction of new methods of analysis for the process control of these solutions.

Investigating Proprietary Solutions

Another interesting problem is the analysis of proprietary plating solutions recommended by supply houses. This often provides interesting information of much use to the plating chemist and, more particularly, to his employers who can then use similar plating solutions at a far cheaper cost. Impurities are not often the subject of detailed analytical practice. However, trace impurities may occasionally be present in the materials or solutions used in a particular vat. Perhaps a good example is the determination of zinc traces in nickel solutions. Copper vats are also occasionally contaminated. The presence of zinc gives immediate trouble as indicated by the poor quality of the plate, but a method for its determination is not really essential. As soon as zinc is discovered in a certain vat, the vat solution is cleaned by plating on scrap work. Since time is an important factor in the industry, the vat solution is cleared of the contamin-

ating impurity in much less time than it would probably take to determine it accurately. Even if the amount of impurity were known, the problem of removing it would still remain. However, the amounts of impurities present in vat solutions are important in research work and methods are required for these determinations.

The improvement of existing processes calls for much analytical control if satisfactory plating solutions are to be obtained. The same considerations, applied above to plating solutions, hold for this aspect of the chemist's duties. The development of new processes is, as mentioned above, primarily the job of a trained and experienced chemist. The transition from laboratory to production scale calls for stringent control, especially since errors are readily made by the non-technical labour employed on the vats. This labour problem is quite a headache for the plating chemist.

The research problems of the plating industry are of two types: (a) pure research on fundamental electrochemistry, and (b) applied research into the production problems within the industry. The plating chemist seldom has the chance to carry out pure research, but confines his attentions mainly to problems of production in his own firm. The supply houses also carry out applied research to improve their products.

The analysis of plating solutions is confined generally to the determination of major constituents. A typical nickel-plating solution might consist of the following substances:—

Nickel sulphate heptahydrate	200 g. per l.
Boric acid	20 g. per l.
Sodium chloride	20 g. per l.

Accuracy of Analysis

Since the accuracy required in the analysis of such a solution need not be better than ± 0.6 g. per l., almost any method for the determination of each constituent can be applied. Thus, the above solution would be analysed for nickel, boric acid and chloride: the nickel may be determined by electrolysis or cyanide titration, the boric acid by alkalimetric titration and the chloride by argentimetric titration in the presence of chromate. Most methods of analysis used in the plating industry are direct applications of methods used in metallurgical analysis. Bright nickel-plating is usually done from solutions containing

organic substances such as *p*-toluene sulphonamide and saccharin. The presence of these substances may introduce difficulties in the analytical procedures as no separation method has been published for mixtures of these two materials. However, since they are normally used in saturated solution, it is not often necessary to check the amounts of these substances in the plating solution.

Similar Considerations Applicable

Similar considerations apply to analysis of the chrome liquors used for chromium plating. A chrome solution might consist of:—

Chromic anhydride	250-500 g. per l.
Sulphuric acid	2.5-5 g. per l.

Impurities are often present in chrome solutions, the effects of nickel, copper and zinc being most deleterious. Iron and lead, from the anode materials, are precipitated and their determination in the chrome solution is no easy task. The most satisfactory procedure depends on the prior removal of chromium as the volatile chromyl chloride. After fuming, the impurities can be determined by normal metallurgical procedures. The sulphuric acid, which is present as a catalyst, is often replaced by fluosulphuric acid, H_2SO_4 , and some difficulty is encountered in the analysis of this constituent in the presence of such a high concentration of chromium. Speed is a major consideration if plating-solution analytical practice, especially where production control is required. This need for speed reflects somewhat on the available methods of analysis but, as the results are required to be only moderately accurate, most routine methods which are simple, reasonably accurate and rapid can be used. It is desirable that such methods as are used should require little or no technical knowledge for their operation. The routine analyses can then be carried out by unskilled or semi-skilled operatives.

Most methods used in the plating industry are physical or instrumental methods. Electrodeposition is often used to determine the major elements in plating solutions. However, there is a considerable difference in electrodepositing a metal quantitatively and electroplating an article with the same metal. Difficulties often arise during such analyses owing to voltage fluctuations, but methods involving controlled potential electro-analysis should help considerably where applied to the analysis of plating solu-

tions. Electro-titrimetry is also used to a large extent and is useful for the direct titration of chromic acid with ferrous ammonium sulphate. 'Spekker' or absorptiometric methods can readily be applied and are very rapid where series determinations are required, although such methods need more attention than those involving electrodeposition.

Spectrograph Sometimes Used

The spectrograph is occasionally used for the detection of trace impurities, although such instruments are not as a rule available even in the largest companies; spectrographic work is generally confined to those research establishments which can afford to purchase this instrument. Conductimetric titration procedures are applied to a limited extent, especially for chromium and iron. The conversion of chromic acid to trivalent chromium at the cathode results in a fall in the electroconductivity of the system. This reduction of electroconductivity is proportional to the concentration of Cr^{+++} and the concentration of Fe^{+++} . Thus, a plot of the concentrations of both these ions, against the electroconductivity gives the necessary data for the determination of both these elements, knowing the electroconductivity of any given mixture of chromium and iron. Another physical method, known as the 'volt-amp.' method, is widely used for the analysis of chrome solutions. By increasing the current passing through the chrome bath and observing the voltage change during the process, the voltmeter needle gives a sudden, sharp kick which results from the properties of the solution at this particular point. If the current passing through the solution at this point is plotted against the ratio of chromium to sulphuric acid, a curve is obtained which enables this ratio to be determined for any solution. This method is both rapid and satisfactory, and is suitable for routine use.

The determination of mercury in plating solutions is occasionally required, since its presence leads to serious difficulties during the plating process. There is no permissible limit for mercury because of these difficulties. Small amounts of mercury are usually determined either using a stannous chloride reduction or by precipitation of some organo-mercury complex. Very small amounts (ca. 0.001 per cent) have been

determined spectrographically using a porous carbon electrode in the spark discharge.

The determination of fluosilicic acid, mentioned above, might be carried out by precipitation of the acid as its insoluble potassium salt. The solution should be saturated with potassium chloride and the precipitated salt then determined by alkali-metric titration. The barium salt could also be used, although the presence of sulphate might cause some difficulty.

A serious economic problem in the plating industry is the discharge of waste solutions. Larger concerns have lime pits to neutralise the acid sewage, but cyanide solutions are not normally treated before discharge. If the treatment of effluents becomes compulsory by law, then many of the smaller plating concerns will find it impossible to continue their business on an economic scale. There is a great need for co-operative measures to be taken by the local water boards and the chemical industries if such occurrences are to be avoided.

Standards for Solvents

TWO further standards, Ethyl Methyl Ketone (B.S. 1940: 1953) and *iso*Butyl Methyl Ketone (B.S. 1941: 1953), in the series for solvents and allied products have just been issued by the British Standards Institution.

These materials were not included in the original series of standards for solvents, although a British Standard Aircraft Material Specification 3.D.1 'Methyl Ethyl Ketone,' was published in 1929. Standard of production of this material has now improved and the demand for general purposes has increased. The new British Standard 1940 'Ethyl Methyl Ketone (Methyl Ethyl Ketone)' therefore supersedes Specification 3.D.1.

No earlier standard existed for *isobutyl* methyl ketone, but the increased demand for material of a reliable quality for a variety of industrial uses justifies the preparation of B.S. 1941 '*iso*Butyl Methyl Ketone (Methyl *iso*Butyl Ketone).'

Further standards in this series, including several for materials used as plasticisers, are being prepared and will be issued shortly.

Copies of these standards may be obtained from the British Standards Institution, Sales Branch, 24 Victoria Street, London, S.W.1 (price 2s. each).

Heat Transfer in Water-cooled Tubes

Investigations to Help the Equipment Designer

THERE is a marked scarcity of design data concerning systems in which fuel gas burns in a tube for heating purposes. In the case of post-aerated town gas issuing from a circular jet and burning under natural draught in a vertical water-cooled tube coaxial with the jet, the resulting flame is invariably a protracted luminous one, which starts to roar when the gas rate is increased to turbulence.

Heat is transferred from the flame by convection and by flame and gas radiation. Radiation from luminous flames cannot be easily or accurately assessed because of the difficulty of estimating the flame emissivity. The effect of the conditions of combustion on the flame properties are not fully known.

It would be desirable for the equipment designer to know the total thermal efficiency of the system, the rates of heat transfer along the tube, the proportion of heat transferred by radiation and by convection, the amount and effect of the air entrained in the system, and finally, the maximum and optimum amounts of gas that can be burned for a certain arrangement.

Experiments Undertaken

A factorial group of experiments to investigate the effect on the flame properties and the heat transfer of the tube length, the gas pressure, the jet diameter and the distance separating the jet from the lower end of the tube was therefore undertaken in the chemical engineering laboratories of the Battersea Polytechnic, London, S.W.11.

This work, which has been approved by the University of London for the award of the Ph.D. degree was described in a paper 'Heat Transfer from Luminous Gas Flames in Vertical Water-cooled Tubes,' by M. E. Saleh, Ph.D., and S. R. Tailby, Ph.D., F.R.I.C. (Associate Member), delivered at a meeting of the Institution of Chemical Engineers held in London on 10 February from which the following report is abstracted.

In these experiments the first factor (tube length) was taken at three levels (6, 5 and 4 ft.). The gas pressure was taken at three levels ($1\frac{1}{2}$ in., 1 in. and $\frac{3}{4}$ in. w.g.) the jet diameter at three levels (0.189, 0.166, 0.144 in.), and the separation only at two levels

(4 in. and 1 in.). Thus the total number of experiments necessary for full replication was $3 \text{ by } 3 \text{ by } 3 \text{ by } 2 = 54$.

The main heating tube and the calorimeters were built as six separate identical units, any number of which could be assembled on top of each other to form a vertical tube of the required length.

Each unit consists of two mild steel concentric tubes of 2 in. and 6 in. I.D. bounded at each end by a steel flange 7 in. O.D. Two pairs of sighting tubes $\frac{1}{8}$ in. I.D. were fitted in line radially through the annular space at distances 6 in. apart and 3 in. from the nearest flange.

Rate & Temperature Measured

Water fed in near the bottom of each calorimeter could be run off near the top into a graduated cylinder to measure its rate. The water temperature was measured before entering and after leaving each calorimeter. The temperature of the inner tube wall was measured at 1 ft. intervals up the tube. Each calorimeter was lagged to prevent loss of heat.

Pressure of the town gas used was adjusted by a governor, metered and passed to the burner, which consisted of a $\frac{1}{4}$ in. O.D. smooth tube, 12 in. long and threaded at the upper end to house the jets. These jets were of the standard circular-channel type commonly used in the gas industry.

A standard black body radiator for the radiation and temperature measurements was constructed from a silicon carbon target $1\frac{1}{8}$ in. diameter fitted inside an electric tube furnace. This furnace was fixed on a platform that could be traversed parallel to the axis of the main unit and be secured in such positions as to align the black body with any of the sight tubes of the calorimeters.

To measure the flame radiation, a total radiation diaphragm pyrometer was constructed, comprising a Moll microthermopile of 18 manganin-constantan junctions and zinc black receiving surface of $\frac{1}{8}$ in. diameter to which was attached a $\frac{3}{8}$ in. O.D. brass tube fitted with four brass diaphragms.

The pyrometer was water-cooled to keep its cold junction at a constant temperature and to prevent the end diaphragm being

heated by the flame. The pyrometer was calibrated against the standard black body radiator, and the calibration curve was found to be a line with very slight curvature near the origin.

Temperature of Flue Gases

Temperature of the flue gases was measured by a suction pyrometer made of a platinum/13 per cent rhodium platinum thermocouple surrounded by a nickel spiral of four turns, and then further shielded by two stainless steel tubes of $\frac{1}{4}$ in. and $\frac{1}{2}$ in. O.D. The nickel spiral restricted the amount of gas aspirated; the rate necessary to give the highest temperature reading was only about 12 cu. ft./hr., which did not disturb the flame.

The appropriate jet was screwed into the burner and placed at the proper distance from the base of the tube. The burner was lit, the gas pressure adjusted to the required value and the rate of flow of water through the calorimeters regulated to permit a temperature rise of 10-20°C. The apparatus was then left to attain equilibrium. The gas rate and some of its properties were meanwhile determined.

When equilibrium was reached, usually after one hour, the temperature of the water entering and leaving the calorimeters as well as the temperature of the tube wall were measured. The rate of flow of water through each calorimeter was measured at the same time. The flue gases were sampled and analysed and their temperature measured with the suction pyrometer. The wet and dry bulb temperatures of the air were recorded.

Radiation from above the flame was measured with a cold background, and also that from the flame backed by the black body radiator set successively at two temperatures of about 100°C. below and above the estimated temperature of the flame.

For each of the two black body settings two measurements of its temperature were made, one immediately before and the other immediately after the radiation reading. The difference between these two temperature readings was not allowed to be more than 1.5°C., and their arithmetic mean was used as the temperature of the black body corresponding to the radiation readings.

Heat input to the system was based on a gross calorific value of the gas of 500 B.Th.U./cu. ft.; the heat output was esti-

mated by means of the calorimeters. A heat balance was made by measuring the temperature of the flue gases and analysing them for CO_2 , CO and O_2 . From the analysis of the fuel gas and the flue gases, the amount of air entrained and the percentage of the water vapour in the flue gases were evaluated.

Emissivity and temperature of the luminous part of the flame were obtained by the Schmidt method, which consists of three total radiation measurements.

For the combustion products the temperature was measured by the suction pyrometer and the emissivity evaluated from published curves (non-luminous radiation for carbon dioxide and water vapour).

Convective heat transfer in the system was obtained as the difference between the total and radiant heat transfer.

Air entrained in the system was considerably more than the theoretical quantity required for combustion (excess air ranged between 4 per cent and 308 per cent, with an average of 103 per cent of the theoretical requirement). This quantity was found to increase mainly and almost linearly with the tube length. Most of the air seemed to flow in a streamlike layer between the luminous flame and the tube wall, so that the mixing of air and gas was mainly a diffusion process.

No Improvement in Mixing

Even when the gas rate was increased until turbulence was reached and the flame started to roar there was no marked improvement in this mixing, judged by the length of the visible flame, or by the radiation and total heat transmission from the flame, all of which remained almost unchanged.

Increasing the jet diameter was found to be the most effective way of reducing the proportion of entrained air. This, in turn, increased the flame length, the flame emissivity and hence the radiation from the flame.

Excess air in the system was also reduced—though to a lesser extent—by increasing the gas pressure.

Because of the effect of the jet diameter on the air entrainment and consequently on the flame length, it was invariably found that, for a certain tube length, the quantity of gas which could be completely burned in the tube increased with a decrease in jet diameter.

Total efficiency of the system was found

to improve slightly by increasing the distance separating the jet and the lower end of the tube from 1 to 4 in. but much more by increasing the tube length. For maximum efficiency the separation should be about 1 in. for a gas consumption of less than 30 cu. ft./hr. This should be increased up to 4 in. for higher rates.

Although the total efficiency of the system was improved by increasing the tube length, this was partially offset by the corresponding increase in air entrainment, which caused a higher flue loss. This may be remedied by using larger jet diameters with longer tubes and vice versa.

Luminous radiation from the flame has proved to be of great importance and attention should therefore be paid to the factors which improve it.

Because nearly all the factors which improve radiation lead to a strengthening of the flame, the difficulty of providing a sufficiently long tube has to be overcome. One obvious solution to this problem is the use of turbulence promoters to speed up the combustion reaction and to improve convection in the end part of the flame, where radiation has ceased to be of importance in the heat transfer process.

Four Variables Chosen

In this study of conditions affecting the heat transfer from burning post-aerated town gas in a water-cooled vertical tube the four variables chosen were the tube length L (ft.), gas pressure P (in w.g.), jet diameter J (in.), and the distance separating the gas jet from the lower end of the tube S (in.).

If Q = rate of air entrained in cu. ft./hr.
 $Q = 12 L + 144 P + (426 - 870 P) J + 190$.

Percentage total efficiency (that is, heat output as a proportion of gross C.V.) is given by—

Per cent total efficiency =
 $6.64 L + 23 P + (1,229 - 3,280 J - 139 P) J + 0.34 S - 92$.

The percentage radiant efficiency based on the gross C.V. is given by—

Per cent radiant efficiency =
 $- 10.7 L + 23 P (1,520 - 140 P - 4,920 J + 18 S) - 3 S - 89$.

Convection coefficient h_{conv} , in B.T.U./sq. ft./hr. °F. is given by—

$h_{conv} = 0.15 L + 0.87 P + 8 J - 1.29$.

For a 2 in. I.D. tube the use of a jet diameter of 3/16 in. for a 6 ft. tube, or 11/64 in. for a 5 ft. tube or 9/64 in. for a 4 ft. tube is suggested.

Curves relating the variables have been obtained.

It has been shown that luminous radiation from the flame is of great importance, and the difficulty of providing a sufficiently long tube has to be overcome. One solution to the problem is the use of turbulence promoters to speed up the combustion reaction. Further work along these lines is proceeding.

Gypsum for Sea-Flooded Land

PROBLEMS of how best to deal with sea-flooded lands when the waters eventually subside were discussed by Professor Sir James Scott-Watson, C.B.E., M.C., I.L.D., chief scientific and agricultural adviser to the Ministry of Agriculture and Fisheries and director-general of the National Agricultural Advisory Service, in a broadcast on Friday evening, 6 February.

To hasten the clearing of salt, Sir James referred to a system of applications of big dressings of gypsum, which had been worked out by the Dutch, and stated that the Ministry was looking into the question of gypsum supplies.

The system mentioned by Sir James was dealt with by Professor Stephen Watson in an article entitled 'Salt Water Inundation in the Netherlands' (*Agriculture*, September, 1947).

In the old days when the sea broke in, gradual correction of the soil condition was brought about by the calcium carbonate which was a natural constituent of the soil, but this was a very slow process.

The Dutch found that calcium sulphate, or gypsum, was a much more suitable and rapid means of attacking the problem, the calcium turning out the sodium which, together with the sulphate portion of the gypsum, passes to the drains.

Restorative properties are said to be remarkable. The dose is not known exactly but varies from one ton on lighter soils to three or more tons per acre on heavy soils.

Use of gypsum is claimed to shorten the recovery of soil structure by three to seven years on the heaviest soils.

IN THE EDITOR'S POST

Large Size Measuring Flasks

SIR,—As the largest producers of volumetric laboratory glassware, and as pioneers of this branch of the industry in Great Britain, we from time to time receive inquiries from laboratories at home and abroad for 3, 5, and 10 litre measuring flasks. The maximum capacity generally available is only 2 litre.

Inquiries are never for more than one or two of these larger sizes, but we suspect there may be a much larger potential demand. If we could hear from users or laboratory furnishers who feel they have a need for these exceptionally large capacity measuring flasks, then it will enable us to assess the approximate overall requirements. If this would then warrant the not inconsiderable expenditure in laying down the cost of the moulds, we would seriously consider making these available. The greater the demand is for these flasks, would help us very considerably in lowering the final cost by enabling us to spread the initial capital expenditure on the moulds.

At the moment, the information at our disposal indicates that demand would only amount to approximately twelve of each size per annum, but we think that the market potential is very much greater if users requirements were more widely known to us.

In requesting inquiries, we do so as part of the 'E-MIL' service in our endeavours to meet the special needs of chemists whether they are large or small.

Yours faithfully,

S. H. ELLIOTT.

Managing Director,

H. J. Elliott, Ltd.

Obituary

Mr. F. C. Dyche-Teague

We regret to announce the sudden death on 3 February of Mr. FRANCIS CLIFFORD DYCHE-TEAGUE, B.Sc., F.R.I.C., F.C.S., managing director of Detel Products, Ltd., makers of protective coatings against acid. Mr. Dyche-Teague was founder of the company and pioneer of British chlorinated rubber.

The Physical Society

37th Exhibition to be Held in April

GROWTH of the use of electronic techniques in general laboratory and industrial instruments will be seen in the 37th annual exhibition to be held at the Imperial College of Science and Technology, Imperial Institute Road, London, S.W.7, from Monday 13 to Friday 17 April.

On the opening day the period from 10.30 a.m. to 2.0 p.m. will be reserved for Fellows and Press only, the exhibition being open until 8.0 p.m. On Tuesday, Wednesday and Thursday the hours will be from 10.0 a.m. to 8.0 p.m., and on the final day from 10.0 a.m. to 5.0 p.m.

This year the whole exhibition is confined to the main building of the college, with the exception of one heavy item to be housed in the mathematics department of the Huxley Building in Exhibition Road (opposite the Science Museum).

Much new and original equipment will be on show, and while the appeal will be primarily to physicists, with the penetration of instruments into almost every field of technology—medical, industrial, research and educational—there should be much to interest the scientific visitor whatever his field may be.

As in previous years a comprehensive handbook of the exhibition will be published early in March and may be obtained at the exhibition or from secretary-editor, the Physical Society, 1 Lowther Gardens, Prince Consort Road, London, S.W.7 (price 6s., post paid 7s. 3d.).

In addition to the Exhibition, the Craftsmanship and Draughtsmanship Prize Giving will be held in the large chemistry theatre on Monday 13 April at 5.0 p.m., and there will be three evening discourses.

These lectures each of approximately 45 minutes duration will be given in the large chemistry theatre as follows:—

Tuesday, 14 April, 6.45 p.m. Dr. E. C. Bullard (National Physical Laboratory): 'Seismic Study of Oceans Basins.'

Wednesday, 15 April, 6.45 p.m. Dr. L. A. Jordan (Paint Research Station): 'Particles, Pellicles; Pigments, Paints and Physics.'

Thursday 16 April, 6.45 p.m. Professor W. V. Mayneord (Department of Physics, Royal Cancer Hospital): 'Scintillation Counting and its Medical Applications.'

Water Supplies for Oil Refining

RIC Members Meet with Gravesend Engineers

THE London Section of the Royal Institute of Chemistry and the Gravesend Engineering Society held their annual joint meeting at the Gravesend Technical College on 13 January when Dr. M. Benger, of the Anglo-Iranian Oil Company, presented a paper 'Water Supplies for Oil Refineries.'

Dr. Benger dealt with the three types of water normally required for a large oil refinery; these were:—

- (1) Cooling water.
- (2) Industrial fresh water.
- (3) Potable water.

Between 20 and 30 gallons of cooling water must usually be pumped for every gallon of oil processed (he said). Water from a fresh water river was ideal, but, alternatively, sea water could be used.

The use of sea water always raised corrosion hazards and was avoided where even a limited fresh supply was available. Ideally the water should have a hardness of between 100 and 200 parts per million and a pH value of about 7.5. When the supply of fresh water was limited, the use could be made of cooling towers and thereby the amount required was reduced to about 5 per cent of that needed for a once through system. The design of the cooling towers was considered in some detail and it was pointed out that the 5 per cent previously referred to was employed as makeup for the blow down necessary to prevent solids concentration. In a re-circulating system, it was usually necessary to use an algicide, such as chlorine in an intermittent dosage to leave 2 parts per million free chlorine. Bromine and sodium pentachlorophenate had also been employed for this purpose. Chlorination must also be employed when sea water was used as a precaution against fouling by marine growths.

Principal Use

Fresh industrial water was principally required for boiler feed purposes. The working conditions and lay out of a refinery usually resulted in not more than 50 per cent of condensate being returned, for much of the steam used was irrecoverable. The water softening plant should therefore be

capable of dealing with about one gallon of water for every gallon of oil processed. The degree of de-mineralisation required in feed water varied considerably according to the type of plant in use, but conservative and safe estimates for the permissible concentration of dissolved solids in a boiler were as follows:—

Up to 100 lbs./sq. in.	5,000 pts./10 ⁶
100 to 250 lbs./sq. in.	2,000 pts./10 ⁶
250 to 500 lbs./sq. in.	1,500 pts./million
500 to 1,000 lbs./sq. in.	1,000 pts./million
Greater than 1,000 lbs./sq. in.	500 pts./million

Even when these figures were adhered to, a careful watch must be kept on the amount of silica present, particularly on high pressure installations, since volatilisation could occur even with the best operating conditions, resulting in undesirable deposits in turbines. It therefore followed that unless the solids in the feed water could be kept to a fairly low figure, the amount of boiler blow down required might become quite uneconomic.

For the reasons outlined above, such processes as lime-soda or conventional zeolite softening, which did not substantially reduce the total dissolved solids, were not sufficiently effective and refinements must be introduced.

Organic resins had now largely replaced the natural zeolites and water of high temporary hardness could often be dealt with by the sodium hydrogen ion blend process. In this process part of the stream was passed through a resin bed which had been regenerated with dilute acid and was capable of replacing the cations of mineral salts with hydrogen. The other part of the stream had the cations replaced by sodium in the normal manner and on mixing and air blowing, the whole of the temporary hardness was finally removed as carbon-dioxide. This process in a modified form using a single mixed bed was known as the starvation process. These processes were of little value for water high in chlorides and in such instances complete de-mineralisation or de-ionisation plant must be installed, or.

alternatively, resort made to evaporation.

De-mineralisation was normally rather cheaper than evaporation, but called for comparatively large quantities of chemicals since the chemical efficiency of regeneration seldom exceeded 35 per cent of theoretical. Normally de-mineralisation would have little effect on the silica content of the water which as mentioned earlier would be dangerous, but recently a new strongly alkaline type of resin had been developed which would absorb silica.

Potable water, which was required in comparatively small quantities only become a problem in undeveloped areas where it was not available from local authorities. In undeveloped areas the quality of the supply became the refinery's responsibility. Great care must be taken to ensure that the necessary standards for mineral and bacteriological quality were maintained. In certain instances the only possible source of supply might be through distillation and the question of suitable additives must then be considered. A distilled or de-mineralised water supply was not necessarily sterile and chlorination might still be required.

Finally, the question of safe disposal of effluent had to be considered. Oil separators were required to take care of inevitable leaks and spillages and the safe disposal of spent chemical solutions which contained objectionable compounds required special equipment. Acid solutions must be neutralised with lime and sulphur compounds and could normally be oxidised to become unobjectionable by air blowing.

The lecture produced a lively discussion, many of the points raised being concerned with the efficacy of various algicides employed. Dr. Bengier dealt with several questions on the probable effect of the Isle of Grain Refinery on local water supplies and pointed out that their source of industrial fresh water was drawn from the chalk beds and not the natural green sand which was the local source of supply. He commented on the wide variation in chloride content which had been encountered in water from wells only a few hundred yards apart.

Change of Name

The following change of name has been announced: Western Lithopone & Barytes Co., Ltd., to C. Z. C. (Sales), Ltd., on 6 January, 1953.

Microscopical Methods

THE Industrial Section of the Royal Microscopical Society, in co-operation with the Optical Group of The Physical Society, the Physical Methods Group of the Society of Public Analysts and Other Analytical Chemists, and the Industrial Spectroscopy Group of the Institute of Physics is organising a meeting which is to be held at King's College, London, on 20 March. The subject is 'Development in Microscopical Methods' and the first session, which will commence at 2.30, will consist of a lecture demonstration entitled 'The Use of the Polarising Microscope in Organic Chemical Research.' The second session will commence at 4.30 and will be comprised of a number of short papers the general theme of which will be 'Useful Attachments to the Microscope and Analytical Methods.' A number of exhibits and demonstrations illustrating the same theme will be on view in adjacent laboratories. At the third session, commencing at 6.15, a lecture demonstration on 'Cinemicrography' will be given.

Full details of the meeting with synopses of the papers and short descriptions of the exhibits are given in the programme which can be obtained from the assistant secretary, Royal Microscopical Society, Tavistock House South, Tavistock Square, London, W.C.1.

Aluminium Filler Alloys

FOUR types of aluminium alloy suitable for brazing a number of alloys complying with the series of British Standards for aluminium and aluminium alloys (namely B.S. 1470 to 1477 and 1490) are covered in the new standard 'Aluminium Filler Alloys for Brazing,' B.S. 1942: 1953 now issued by the British Standards Institution.

Chemical composition and limits of impurities together with the form of material are specified, and the approximate melting ranges are given for information.

This new standard is complementary to B.S. 1723, 'Brazing' and to B.S. 1845, 'Filler alloys for brazing (silver solders and brazing solders).'

Copies may be obtained from the British Standards Institution, Sales Branch, 24 Victoria Street, London, S.W.1 (price 2s.).



The Chemist's Bookshelf

ORGANIC SYNTHESSES, Vol. 32. Edited by R. T. Arnold. John Wiley & Sons Inc., New York; Chapman & Hall Ltd., London, 1952. Pp. 119. 28s.

It is a significant tribute to the editors of this annual publication that today, when well over 1,000 organic preparations and procedures must have been described, each fresh volume is of the widest possible interest to the practising organic chemist. There is as ever a nice balance between the familiar and the esoteric, between the simple and the complex compounds, and also between the various divisions of organic chemical structure. What has come into being as a result of the publication of these volumes is a complete guide to the production of a large number of the most widely used chemical intermediates. Much of the fundamental description has appeared in the collected volumes, but there is still the possibility of finding a fresh authenticated method for intermediates of wide application in the volumes appearing now at the end of each year. Such a compound is acrolein diethyl acetal. When treated with ethanol and hydrochloric acid this unsaturated aldehyde gives no acetal and poor yields are obtained when recourse is made to triethyl orthoformate. A method is included here, however, which by the adaptation of a procedure described in the patent literature gives an 80 per cent yield using ammonium nitrate as the condensing agent. It is suggested that this method is a general one for the production of acetals from unsaturated aldehydes, those mentioned particularly being crotonaldehyde and tiglic aldehyde.

A second service which 'Organic Syntheses' provides is the familiarisation of new chemical techniques. An example of this is given by the separation of amino acids from hydrolysates by the use of ion exchange resins. Although most chemists will be familiar with the principles underlying ion exchange procedures many will be grateful for the precise instructions given for

carrying out such a separation as in the preparation of ϵ amino caproic acid. The hydrochloric acid is removed from the solution of hydrolysed caprolactam by the use of a column of Amberlite I-R 4-B. Another example of the newer techniques is the reduction of dichloroacetyl-chloride to dichloroethanol by the use of lithium aluminium hydride.

A preparation which may be of interest to the analytical chemist as well as the preparative worker is that of cyclohexanediene by the oxidation of cyclohexanone with selenium dioxide. The dioxime of this α diketone has been recommended as a reagent for nickel and replaces the more familiar dimethyl glyoxime over which it has certain advantages. It is rather strange, however, to find that the route selected for the preparation of a α -diphenyl succinonitrile should be by the addition of hydrogen cyanide to a phenyl cinnamonitrile. Apart from the comparative difficulty of obtaining the parent substance and the need to work in a fume cupboard there exists a much simpler route involving the action of iodine upon the sodium salt of phenyl acetonitrile.

The index at the end of the present volume is an accumulative one including material from the previous two volumes.—J. R. M.

AN ADVANCED TREATISE ON PHYSICAL CHEMISTRY. By J. R. Partington. Vol. III —The Properties of Solids. Longmans Green & Co., London. Pp. ix + 639. 70s.

The reception accorded to Vols. I and II of Professor Partington's 'Treatise on Physical Chemistry' ensures a ready welcome for the work under review, which is concerned with the properties of solids. In spite of the inclusive nature of the title, this volume of some 600 pages deals with mechanical and thermal properties only. Consideration of the electrical and optical properties of solids is postponed to a later volume. It can be said at once that Vol. III meets in every way

the high standard set by its two predecessors.

The reader is now accustomed to expect two things from Professor Partington—meticulous attention to detail coupled with a strong feeling for the historical side of his subject. Almost his greatest anxiety is to ensure proper recognition of priority of discovery and in face of the present floods of scientific literature such a care is wholly admirable. As Professor Partington says himself, the delusion that the most recent work is likely to be the most accurate is surprisingly widespread.

Vol. III opens with a general survey of the solid state and of diffusion and chemical reactions in solids followed by a brief but lucid summary of the principles of X-ray crystallography. Sections follow on isomorphism, density, the general mechanical properties of solids, specific heats and thermal conductivity, and finally a very useful account of the phenomena and theories of fusion. Choice of subject matter for Vol. III has obviously been difficult. Thus, X-rays are dealt with in detail, while electron diffraction is omitted, and magnetic properties are but cursorily mentioned. Perhaps these omissions will be remedied in future volumes. Experimental aspects are emphasised throughout and where theory has appeared to the author to be incomplete or inadequate he has not hesitated to include, as in earlier volumes, the empirical equations so useful to the engineer and applied scientist. In this way the potential value of the volume has been materially increased.

Like all experimenters, Professor Partington is sceptical of some of the claims of absurdly high accuracy in physical measurements. He cautions the learner in particular against being frightened by the high claims of accuracy made by so many writers on calorimetry. 'The worker need not fear the four or five places of decimals sometimes given, the last two or three of which are usually meaningless.' But for careful work of high accuracy, the author has obviously the greatest respect.

Although the price is high, the printing and production are first class, and the scarcity of obvious misprints suggests a very high standard of proof reading, an important feature in what will be essentially a work of reference. Chemists who already have Vols. I and II on their shelves will need little prompting to add the present work to their set.—R. C. PINK.

SOLUBLE SILICATES: THEIR PROPERTIES AND USES. Volume I—Chemistry. By James G. Vail. New York: Reinhold Publishing Corporation. London: Chapman & Hall, Ltd. 1952. Pp. xii + 357. 72s.

The present work is intended as a replacement of the now out-of-print book, 'Soluble Silicates in Industry,' first written by the same author in 1928. The monograph has been divided into two volumes, of which only the first has yet been published.

The industries that utilise soluble silicates are directly related to the everyday life of a nation, and consequently these compounds have an overall importance not possessed by many other chemicals. Large amounts of soluble silicates are consumed in cleansing processes, both industrial and domestic, in the manufacture of corrugated fibre box containers, and in the production of silica gel. They may also be used as adhesives, cements, and deflocculants and for protective coatings. During war-time when fats, oils and phosphates were scarce the industrial demand for soluble silicates was considerably increased. Some idea of the great importance of the silicate industry can be gauged from the fact that in 1949 the world production of sodium silicate was of the order of 1,000,000 tons (calculated as anhydrous $\text{Na}_2\text{O} \cdot 3.35\text{SiO}_2$). Since soluble silicates are derived industrially from silica and sodium salts, both of which are available in abundant quantities throughout the world, the prospect of adequate supply is assured. Ultimately, it seems likely that the soluble silicates will have to be used to replace other relatively scarce commodities, such as starch and phosphates, from some of their applications.

The author has had long service with the Philadelphia Quartz Company, one of the major American manufacturers of sodium silicate, and has written a most useful and interesting book. Volume I is devoted to the more theoretical aspects of the subject, covering in some detail the past and present methods for the manufacture of soluble silicates, the methods for the analysis and testing of these products, the properties of homogeneous and heterogeneous systems of glasses, the formation of metallic silicates, and the fundamental principles behind the use and application of silicates in industry and agriculture.—G.S.E.

HOME

Record Steel Production

Output of steel in the United Kingdom in January reached a new record at an annual rate of 18,009,000 tons compared with the previous record of 17,952,000 tons achieved in November and 15,234,000 tons in January, 1952. Pig-iron production also reached a new record annual rate of 11,121,000 tons in January, an increase of 840,000 tons over the annual rate at the same month last year. With the completion of its development plan and better supplies of raw materials for the expanded capacity, the steel industry should be able to attain its 1953 objective of 17,500,000 tons.

Import Duties

The Treasury has made the Import Duties (Exemptions) No. 1 Order, 1953, which provides that the exemption of potassium nitrate from the general *ad valorem* duty of 10 per cent chargeable under the Import Duties Act, 1932, shall not apply to synthetic potassium nitrate. The order came into operation on 9 February and has been published as Statutory Instruments, 1953, No. 141.

Rutherford Memorial Lecture

The Council of the Royal Society has appointed as the Rutherford Lecturer for 1953, Sir James Chadwick, F.R.S., who will deliver the Lecture at McGill University, Montreal in the Autumn. This is the second Rutherford Lecture to be delivered under the terms of the Rutherford Memorial Fund, the first having been delivered last year in New Zealand by Sir John Cockcroft, C.B.E., F.R.S.

Analysts' Annual Meeting

The annual general meeting of the Society of Public Analysts and Other Analytical Chemists will be held at 2.45 p.m. on Friday, 6 March, in the Meeting Room of the Chemical Society, Burlington House, Piccadilly, London, W.1. This will be followed at 3.15 p.m. by the address of the retiring president, Dr. J. R. Nicholls, C.B.E., F.R.I.C. In the evening the Biennial Dinner will be held at the Hall of the Worshipful Society of Apothecaries of London, Blackfriars Lane, London, E.C.4, at 7 p.m.

Midlands Analysts

The next meeting of the Midlands Society for Analytical Chemistry will be on Thursday, 19 February, at 7 p.m. in the Mason Theatre, The University, Edmund Street, Birmingham, when the subject for discussion will be 'The Analytical Chemistry of Tin and Lead.' It will be introduced by Dr. J. W. Price, of the Tin Research Institute.

Tragic Accident

A few days before he should have received his gold watch for long service, Frederick Robinson, aged 47, process worker at the Trafford Park Works of I.C.I., Ltd., was killed in an explosion in the dyestuffs division on 1 February.

'Chemical Abstracts'

When Sir William Wakefield asked in the House of Commons whether a decision had yet been taken with regard to the steps necessary to ensure the continued publication of 'British Abstracts,' Mr. A. Molson replied on behalf of the Lord President of the Council. Mr. Molson said he understood that the Chemical Council would shortly issue an appeal for funds to enable 'British Abstracts' to continue publication during 1953. The DSIR had already provided £5,000 to enable the Bureau to continue operation while the appeal was being made and, provided a satisfactory financial response was forthcoming from industry, the Government were ready to make a further substantial contribution in 1953.

Working Four-day Week

Mills in the old-type tinplate work in West Wales, belonging to the Steel Company of Wales, have commenced to work a four-day week. This follows the recent closure of ten tinplate works in the area because of high production at modern mills at Margram and Troste, Llanelly.

Plasticiser Prices

A. Boake, Roberts & Co., Ltd., have announced that as from 6 February their prices for *tri*-tolyl phosphate and *tri*-xylene phosphate have been reduced by 1½d. per lb. All outstanding orders and contracts have been amended accordingly.

. OVERSEAS .

Canadian Steel Record

Steel production in Canada last year set a new record of 3,720,000 tons (according to H. G. Hilton, president of the Steel Company of Canada) while consumption during the year amounted to about 5,320,000 tons, also a new high level. When all additions and improvements in Canadian production facilities now projected are completed it is estimated that annual capacity will be between 4,500,000 and 5,000,000 tons, an increase of more than 300 per cent over 1939. Canada would then rank seventh among the steelmaking nations.

Nylon Fibre Production

Production of nylon fibres in Germany has been started by the Rhodiazeta Company which is operating under a licensing agreement with the American company of E. I. du Pont de Nemour. Initial monthly output will be 50 tons. Up till now German manufacturers have specialised in the production of Perlon, a synthetic fibre invented in Germany.

Italian Furfural Plant

The Termodinamica Company is building a factory for the continuous extraction of furfural from exhausted olive cake in Gioia Tauro, Italy. The factory, which will use the Sebava process, was planned after extensive tests had been made on a semi-industrial pilot plant. According to the present plans the factory will be completed sometime this year.

Log Dyeing Process

Mr. Frank H. Day, of Sault-St. Marie, Ontario, has invented a process for colouring the wood in uncut logs with chemical solutions. His patented process is called Kolorwood and involves forcing the solution through a log by means of pressure and centrifugal force. It is said to take about a minute for each foot of wood. A log can be coloured any hue throughout its length, flame-proofed and treated with preservative, Mr. Day says. Native woods, especially white birch can be made to look like expensive imported woods. Mr. Day plans to release the process under licence to manufacturers.

Titanium Output in Japan

An agreement under which the Glidden Company, Cleveland, U.S.A. will provide technical assistance for large-scale production of titanium dioxide in Japan, has been announced. It calls for construction of a new \$6,000,000 plant, the largest of its kind in the Orient, by the Ishihara Chemical Company of Tokio and Osaka, which is a large, integrated corporation engaged in copper mining, ilmenite mining, and sulphuric acid production. The Ishihara Company is well-equipped to produce titanium dioxide, as it has excellent sources of ilmenite in Malaya and is a producer of sulphuric acid. Construction of the new plant, situated between Tokyo and Osaka, has already begun and it is expected to be in production within a year.

U.S.-S.A. Co-operation

Alkalis for cleaning steel and chemicals for purifying drinking water and sewage are among the new range of products to be manufactured locally by Chemical Services (Pty.), Ltd., of Johannesburg, which has for some years been representing the Pennsalt International Corporation of Philadelphia, U.S.A., and is now producing some of the American company's industrial chemicals under licence. Some U.S. capital is expected to be invested in further chemical developments.

Nigerian Lead-Zinc

Notice of the termination of its option agreement on the Abakaliki lead-zinc properties has been given to the Nigerian Government by the American Smelting and Refining Company. The company, which has been associated with the Mines Development Syndicate of London in exploration of these properties in Southern Nigeria, states that serious water problems were encountered. The existence of payable ore-bodies was established, but the mine would not be on a scale originally envisaged by the company. The Mines Development Syndicate is expected to continue with the development as Government geologists have reported good prospects for the ore-bodies already proved.

• PERSONAL •

MR. M. W. THRING, M.A. (Cantab.), F.Inst.F., F.Inst.P., has been appointed an assistant director of research of the British Iron and Steel Research Association. He will continue as head of BISRA's Physics Department.

DR. G. A. JEFFREY, of Leeds University, has accepted a permanent post as a professor of chemistry at Pittsburgh University, U.S.A., and will sail for America in August. Dr. Jeffrey, who has been supervising research work at Leeds since 1945, went to Pittsburgh in 1950 to set up an X-ray section similar to the one attached to the Chemistry Department at Leeds University.

Present and former members of The Gas Council gave a dinner at the Connaught Hotel, Carlos Place, on 3 February, in honour of COLONEL HAROLD SMITH, chairman of The Gas Council, who was awarded a K.B.E. in the New Year Honours. Present members of the Council attending were:—Mr. H. F. H. Jones (deputy chairman), Sir Andrew G. Clow, Mr. E. Crowther, Mr. D. P. Welman, Dr. R. S. Edwards, Mr. S. Smith, Mr. G. le B. Diamond, Mr. T. Mervyn Jones, Sir John W. Stephenson, Mr. M. Milne-Watson, Mr. W. K. Hutchison, Mr. A. R. McBain, Mr. C. H. Chester and Mr. P. G. Brewer (secretary). Former members present were: Sir Edgar Sylvester (past chairman), Col. W. M. Carr and Mr. O. R. Guard.

MR. L. A. ELGOOD is relinquishing the chairmanship of the Distillers Company as from 31 March, but will continue as a member of the committee. MR. C. G. HAYMAN has been appointed chairman of the management committee with effect from 1 April.

MR. H. WILLSHAW, O.B.E., Dunlop's chief engineer, has sailed for Brazil on the *Alcantara* to assist in the construction, near Campinas, north of Sao Paulo, of the new factory for Dunlop do Brasil and the installation of its plant. Mr. Willshaw will advise on the technical and engineering problems involved in the up-to-date equipment of the factory which is the company's latest to be erected overseas.

DR. S. M. HERSCHDOERFER has been appointed chief chemist of T. Wall & Sons, Ltd., ice-cream and meat-products manufacturers, of London, Manchester and Edinburgh. He succeeds MR. GEORGE H. SEARLE, the firm's chief chemist for 30 years, who has retired.



Dr. Herschdoerfer completed his education at the University of Vienna. After working in Paris with the dairy combine, Fermiers Réunis, the largest cheese manufacturing concern in France, Dr. Herschdoerfer came to England and took up a post at the National Institute for Research in Dairying at Shinfield, near Reading.

Dr. Herschdoerfer joined Unilever in 1942—first in the research department at Port Sunlight and subsequently with the Food Research Department at Sharnbrook.

MR. THOMAS TOPHAM, chief chemist at John Walton's Glossop (Derbyshire) textile factory, who sails from Tilbury to Melbourne on 27 February to take up an appointment as technical secretary with the Government-sponsored Commonwealth Scientific Research Organisation in Geelong, Victoria, is a native of Bradford. He is 36 years of age and during the war served with the R.A.F., becoming a Squadron-Leader and winning the D.F.C.

MR. R. V. BECKNELL has been appointed manager of the project engineering department of The M. W. Kellogg Company, a subsidiary of Pullman Incorporated, and MR. O. G. MELCHIOR associate manager. Mr. Becknell will serve as administrative head of the department and will be technically responsible for the project engineering on all company work in North, South and Central America. Mr. Melchior will be technically responsible for activities on European contracts.

Publications & Announcements

DETAILS of the Hilger industrial infra-red spectrophotometer developed to the requirements and with the collaboration of the Anglo-Iranian Research Laboratories, are given in the January, 1953, illustrated catalogue (CH 307/5) issued by Hilger & Watts, Ltd. (Hilger Division), 98 St. Pancras Way, London, N.W.1. The instrument is a non-recording one designed for rapid readings by semi-skilled personnel, for controlling the refining and blending of petrols and other industrial applications. It embodies a source of radiation, an arrangement whereby absorption cells can be interposed into the beam of radiation, an optical system to pass the radiation into a monochromator, and a sensitive Schwarz type vacuum thermopile. It is used with a separate galvanometer system.

* * *

A PERMANENT record of the proceedings of the second symposium on 'Indian Oils and Fats and their Utilisation' held in Poona in November, 1951, has now been collected in one volume edited and published by Dr. J. S. Aggarwal, oils and fats section of the National Chemical Laboratory of India (price Re.1-0-0). There is an introduction by Professor J. W. McBain, F.R.S., then director of the laboratory, and chairman of the Vegetable Oils Committee, Council of Scientific and Industrial Research (India) who presided at the symposium. Besides a paper on 'Oil and Allied Industries in India,' covering the scope of the symposium, 49 papers were read and discussed under the following seven sections:—Oil seeds and vegetable oils; oil extraction; soap and glycerine; hydrogenation of oils; fish oils; castor oil, drying oils, paints and varnishes; analytical and other miscellaneous papers.

* * *

MUCH useful information is contained in the *Review of Coal Tar Technology*, January-June, 1952 (Vol. IV, part 1) issued by the Coal Tar Research Association, Gomersal, near Leeds (price to non-members 7s. 6d.). The volume is divided into two sections. The first deals with coal tar, its products, and their utilisation, and the second with general chemistry and chemical techniques and processes. Ample references supply sources of further information if required and there is a subject index.

RATE of polymerisation of styrene in emulsion by means of the dilatometric method is described by J. Bakker in an article entitled 'Kinetics of the Emulsion Polymerisation of Styrene' in *Philips Research Reports*, October, 1952 (Vol. 7, No. 5). Also included are physical, chemical and technical papers dealing with the results of research work both experimental and theoretical carried out in the laboratories of the Philips industries. The reports are edited by the research laboratory of N.V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands.

* * *

'HIGHER Industrial Production with Electricity,' is the title of the introductory volume of a series of eight books on Electricity and Productivity being issued by the Electrical Development Association. The introductory volume (146 pages, with 104 illustrations) is not a technical book, but is written, for management, to describe the wide variety of modern electrical methods and their productivity value as found in practice. Topics dealt with include factory layout and electrical installations, electric furnaces and heat treatment in the production line, materials handling, electric motors and control gear, welding and electrical testing and inspection. There is obviously much of interest to the chemical and allied trades. Copies of the book (price 9s. post paid) may be obtained from the British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

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EXTENSIONS and plant improvement made necessary to meet the increasing demand for its wide range of products form an appropriate introduction to its new 1953 catalogue 'Welded Fabrications' now issued by Robert Jenkins & Co., Ltd., of Rotherham. The scope of the company's activities is comprehensively represented, including many types of storage tanks, mixers, vacuum chambers, deodorisers, moisture traps, monel vapour pipes and other items of interest to the chemical industry. The company also has a team of skilled workmen available for site installations, as an example of which two photographs show stages in the erection of a stainless steel fractionating column for a fatty acid plant at Littleborough.

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PROBLEMS and achievements of the World Oil industry in the years since the war were surveyed in a special supplement issued by *The Financial Times* on Monday, 2 February. The importance of benzole in the production of phenol, largely used for plastics manufacture, styrene for the production of synthetic rubber, and for nylon and detergents is pointed out. In an article on 'Refinery Capacity and World Demands' it is shown how, since the sulphur shortage, recovery of sulphur from refining gases has assumed significant importance. With the installation of sulphur recovery plants it is estimated that by 1955 the total world production of sulphur from refining and natural gases will have reached 1,000,000 tons a year. The bulk of this would, however, be in the U.S.A. with its big refining capacity and highly developed natural gas industry.

PLUG, cap, or clip-on closures made in polythene—either in translucent white or in a variety of colours—are described in its latest pamphlet 'Resoid Closures' issued by Resinoid & Mica Products, Ltd., of London and Birmingham. The closures, being chemically inert and of great strength, are particularly suitable for the chemical, pharmaceutical, cosmetic, and confectionery trades. The company has also issued an illustrated brochure 'Plastics for Industry' covering compression, transfer and injection moulding; laminated tubes, angles and channels; and machining and fabricating. A comparative chart gives in simplified form the main properties of a representative range of plastics. Selling agents for Resinoid & Mica Products, Ltd., are:—Johnsen & Jorgensen Flint Glass, Ltd., 26/2 Farringdon Street, London, E.C.4, and Industrial Appliances, Ltd., 21 Grosvenor Street, London, W.1.

THE first convention of the Scientific Instrument Manufacturers' Association of Great Britain, Ltd., held at Eastbourne, Sussex, from 30 October to 2 November, 1952, proved an unqualified success. Those who were unable to attend this opportunity for the discussion of common problems and exchange of ideas can now have the benefit of the papers and discussions as the 'Proceedings of the First Convention' have now been published by SIMA in the form of an illustrated booklet. The three main subjects discussed were 'Research and Develop-

ment' introduced by Dr. E. C. Bullard (National Physical Laboratory); 'Production,' introduced by Dr. D. F. Galloway (director, Production Engineering Research Association); and 'Export,' introduced by Sir Percy Lister (R. A. Lister & Co., Ltd.). Panel meetings were held on Friday afternoon and Saturday morning, and on the Sunday each chairman gave a general outline of the work of his own panel which was followed by open discussion leading to the opening up of several new lines of work for SIMA. It was agreed that the convention should, if possible, become an annual event in the association's calendar.

PAPERS read and discussed at the 19th annual conference of the National Smoke Abatement Society have now been issued in a booklet entitled 'Proceedings of the Portsmouth Conference, 1952' (price 6s., post paid 6s. 2d.). Contents of the volume include the presidential address by Professor F. E. Tylecote; the Des Voex Memorial Lecture, 'Smoke and the Law,' by W. R. Hornby Steer; a number of 'Progress Reports,' by both British and American contributors; 'Incentives for Industrial Smoke Prevention,' by W. L. Mather; and 'Pollution Problems in the Iron and Steel Industry,' by Professor R. J. Sarjant. Two resolutions approved at the conference are given and there is also a summary both of the technical sessions and the social events. Copies of the booklet may be obtained from Chandos House, Buckingham Gate, London, S.W.1.

SAFETY measures to be employed and regulations to be followed in handling, storing, shipping and disposing of bromine are described in detail in a new safety data sheet, SD149, published by the Manufacturing Chemists' Association, Inc. First aid measures and medical procedures in case of contact with the chemical are also included.

The sharp penetrating odour of bromine gives fair warning of its presence, but inhalation of the vapour should be avoided. The corrosive nature of the material requires strict observance of regulations relating to containers and warning labels. Copies of the 16-page data sheet may be obtained for 25 cents from the Manufacturing Chemists' Association, Inc., 246 Woodward Building, Washington 5, D.C.

U.K. Sulphuric Acid Returns

Production & Consumption in 1952

PRODUCTION of sulphuric acid and oleum (chamber and contact) in the United Kingdom during 1951 totalled 1,505,473 tons which was 100,605 tons less than the previous year and 297,226 tons less than 1950.

Despite lower consumption in 1952, 1,552,023 tons compared with 1,675,590 tons in the previous year, stocks at 31 December, 1952, amounted to 70,170 tons, approximately 5,600 tons less than at the end of 1951.

In the final quarter of 1952 production of chamber and contact sulphuric acid rose by 108,115 tons over the previous three months to 424,630 tons. Stocks at the end of the year also showed an improvement at 70,170 tons, compared with 69,323 at 30 September, 1952.

Consumption also increased during the period 1 October-31 December, 1952, 428,592 tons of 100 per cent H_2SO_4 being used as against 325,726 tons in the period 1 July to 30 September, 1952.

Figures for the year 1952, reproduced in the tables below, are from the summary of returns issued by the National Sulphuric Acid Association, Ltd.

Metal extraction	1,796
Oil refining and petroleum products	70,744
Oils (vegetable)	10,268
Paper, etc.	3,580
Phosphates (industrial)	903
Plastics, not otherwise classified	19,478
Rayon and transparent paper	152,363
Sewage	9,448
Soap and glycerine	19,328
Sugar refining	595
Sulphate of ammonia	278,517
Sulphates of copper, nickel, etc.	26,198
Sulphate of magnesium	3,663
Superphosphates	370,310
Tar and benzole	18,180
Textile uses	19,771
Titanium oxide	97,016
Unclassified	125,667
Total	1,552,023†

† Includes 21,993 tons of imported acid.

PRODUCTION OF SULPHURIC ACID AND OLEUM (Tons of 100% H_2SO_4)

Data referring only to Acid Makers' Returns	Chamber only	Contact only	Chamber and Contact
Stock 1 Jan. 1952	33,644	42,128	75,772
Production	572,107	933,366	1,505,473
Receipts	83,744	53,118	136,862†
Oleum feed	—	5,903	5,903
Adjustments	222	+459	+237
Use	320,481	427,166	747,647
Despatches	337,948	568,482	906,430
Stock 31 Dec. 1952	30,844	39,326	70,170
Total capacity represented	772,920	1,261,920	2,034,840
Percentage production	74.0%	74.0%	74.0%

† Includes 9,571 tons of imported acid.

RAW MATERIALS (Tons)

Data referring only to Acid Makers' Returns	Pyrites	Spent Oxide	Sulphur and H_2S	Zinc Concentrates	Anhydrite
Stock 1 Jan. 1952	111,255	247,679	74,931	53,161	370
Receipts	234,300	249,420	218,461	190,677	176,096
Adjustments	+2,061	-7,888	-1,009	-2	—
Use	217,500	231,329	227,542	165,143	175,951
Despatches*	2,158	19,833	2,656	23	—
Stock 31 Dec. 1952	127,958	238,049	62,185	78,670	515

* Including uses for purposes other than sulphuric acid manufacture.

CONSUMPTION OF SULPHURIC ACID AND OLEUM, UNITED KINGDOM (Year, 1952)

Trade Uses	Tons 100% H_2SO_4
Accumulators	9,304
Agricultural purposes	8,216
Bichromatic and chromic acid	13,312
Bromine	12,187
Clays (Fuller's Earth, etc.)	7,313
Copper pickling	2,399
Dealers	10,464
Drugs and fine chemicals	14,948
Dyestuffs and intermediates	44,455
Explosives	24,714
Export	1,630
Glue, gelatine and size	416
Hydrochloric acid	52,601
Hydrofluoric acid	11,058
Iron pickling (including tin plate)	98,625
Leather	3,107
Lithopone	9,449

New Alumina Plant

A new plant at Mandeville, Jamaica, which will crush the bauxite ore already being mined in Jamaica and reduce it to alumina is nearing completion. Early next year it will become a main source of supply for Canada's great aluminium smelting project at Kitimat in British Columbia. Lack of power resources prevents the alumina from being processed in Jamaica. By late this year the plant is expected to be producing 450 tons a day. The new plant belongs to Alumina, Ltd., one of the 48 subsidiaries of the Aluminium, Ltd., group.

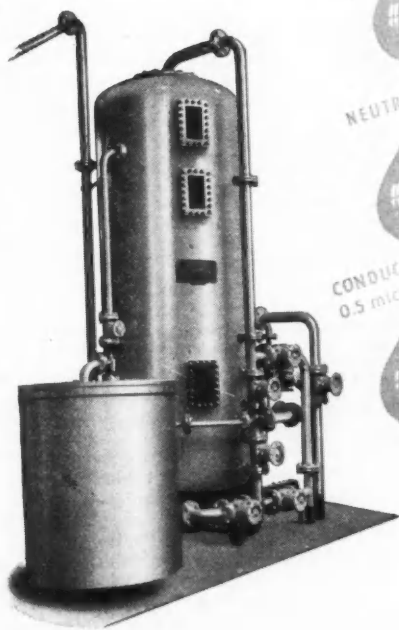
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Next Week's Events

MONDAY 16 FEBRUARY

The Chemical Society

Belfast: Queen's University, 7.15 p.m. Joint meeting with the RIC and SCI. Dr. D. T. A. Townend: 'The Work of the British Coal Utilisation Research Association.'

Cardiff: University College, 5.30 p.m. R. P. Bell: 'Physical Chemistry of Some Reactions of Acetaldehyde.'

Leeds: The University, 7 p.m. Royal Institute of Chemistry Lecture. Dr. C. E. Dent: 'Chromatography in the Study of Amino-acid Metabolism.'

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 5.30 p.m. Crop Protection Panel. 'Physical Factors in Relation to Biological Activity of Insecticides.' Various speakers.

Institute of Metal Finishing

London: Northampton Polytechnic, St. John Street, E.C.1, 6 p.m. Dr. J. Edwards: 'Roughness of Nickel Deposits.'

Institute of Metals

Sheffield: The University, St. George's Square, 7.30 p.m. Joint meeting with the Sheffield Society of Engineers and Metallurgists and the Sheffield Metallurgical Association. W. A. Baker: 'The Constitution and Properties of Some Titanium-Base Alloys.'

TUESDAY 17 FEBRUARY

Society of Chemical Industry

London: Royal College of Science, S.W.7, 2.30 p.m. Dr. A. Eden: 'Substitute Feeding Stuffs.'

Oil & Colour Chemists' Association

London: 26 Portland Place, W.1, 7 p.m. G. E. P. Box, M. E. Hobbs and F. North: 'Pigment Strength Testing with the Automatic Muller.'

WEDNESDAY 18 FEBRUARY

Royal Institute of Chemistry

London: Wellcome Research Institution, Euston Road, N.W.1, 6.30 p.m. Discussion, jointly with the British Association of Chemists. 'Education in Chemistry.' Professor C. K. Ingold and other speakers.

Society of Chemical Industry

Newcastle-upon-Tyne: King's College, 2.30 p.m. Joint meeting of the Chemical Engineering and Corrosion Groups with the Newcastle Section. Dr. W. H. J. Vernon:

'Some Recent Progress in Corrosion Research,' K. A. Spencer and Dr. N. B. Footner: 'Protective Coating for Buried Pipelines.'

Manchester Metallurgical Society

Manchester: Engineers' Club, Albert Square, 6.30 p.m. A. L. H. Perry: 'Metallurgical Aspects of Some Lubricating Problems.'

Institute of Fuel & Institute of Petroleum

Chester: Grosvenor Hotel, 7.30 p.m.. S. J. Young (NCB, North Wales Area): 'Methane at Point of Air Colliery.'

THURSDAY 19 FEBRUARY

The Chemical Society

Edinburgh: North British Station Hotel, 7.30 p.m. Joint meeting with the RIC and SCI. Dr. B. Raistrick: 'The Fertiliser, Phosphorus and Allied Industries.'

Nottingham: The University, 4.45 p.m. Lecture by Professor G. R. Clemo.

FRIDAY 20 FEBRUARY

The Chemical Society

Glasgow: The University, 7 p.m. Annual general meeting of local Fellows, followed by lecture. Professor E. R. H. Jones: 'Allene Chemistry.'

Dundee: University College, 7 p.m. Royal Institute of Chemistry Lecture. Dr. Eric Clar: 'The Significance of Kékulé Structures on the Stability of Aromatic Hydrocarbons.'

Royal Institute of Chemistry

Reading: The University, 6.45 p.m. informal dinner, 8.15 p.m. Professor J. W. Cook: 'Some Aspects of the Chemistry and Stereochemistry of Polycyclic Aromatic Hydrocarbons.'

Society of Chemical Industry

London: King's College, Strand, W.C.2., 7 p.m. Fine Chemicals Group. Short original papers by members.

Institute of Metal Finishing

Sheffield: Grand Hotel, 7 p.m. Sheffield and North-East Branch, dinner and dance.

Institute of Physics

Manchester: The University, 6.45 p.m. J. Blears (Metropolitan-Vickers, Ltd.): 'Mass Spectrometry.'

Institution of Heating & Ventilating Engineers

Manchester: Engineers' Club, Albert

[continued on page 298]

A GREAT RANGE

In Aircraft it's the Lockheed Neptune of America

Now seeing service as a patrol plane with the United States Naval forces, the Neptune has been fitted with auxiliary petrol tanks on the wing tips which increase range to over 4,500 miles—yet allow a maximum speed of more than 300 miles an hour. Operated by a crew of seven and fitted with the latest electronic equipment, the Neptune is obviously a plane that will go far.



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Next Week's Events

continued from page 296

Square, 6.30 p.m. J. C. Stainton: 'Corrosion in Boilers.'

The Textile Institute

Manchester: 10 Blackfriars Street, 1 p.m. A. M. Robertson (Fibreglass, Ltd.): 'Uses of Glass Fibres.'

SATURDAY 21 FEBRUARY

Royal Institute of Chemistry

Leeds: Metropole Hotel, 7 p.m. Leeds Area Section, annual dinner. Members of the Chemical Society and SCI and their ladies are invited. Dr. F. G. Mann will be the guest of the evening.

Market Reports

LONDON.—A good volume of inquiry in most sections has been reported during the past week and the demand for industrial chemicals on home trade account has been well up to recent levels. The seasonal call for fertilisers is developing along the usual lines and among the soda products both chlorate and nitrate of soda are in good request. Price changes have been few. Lithopone is cheaper at £50-£51 per ton for the 28-30 per cent grade, and litharge and red lead are now quoted at £128 5s. per ton. The price of white lead being £144 per ton. Strong competition is being felt in the export trade for coal tar products, while creosote oil and pyridine continue in good demand for home trade.

MANCHESTER.—The recent slight improvement in the demand for heavy chemical products on the Manchester market has been maintained during the past week and home consumers are calling for reasonably steady deliveries of most lines against existing commitments, while a fair aggregate weight of new business has been placed. The shipping movement, mainly to the Empire outlets, has also been on a fair scale. Values are mostly steady, though fluctuations in the non-ferrous metals continue to affect prices of the compounds, sulphate of copper being about £5 a ton cheaper on balance. In the fertiliser and tar products sections a fair demand has been reported during the past few days.

German Plant for English Firm

SULPHURIC acid plant and associated equipment to the designs of a German company will in future be manufactured and sold by the Power-Gas Corporation Ltd., of London and Stockton-on-Tees.

An announcement made by the corporation states that an arrangement has been made with Chemiebau Dr. A. Zieren, G.m.b.H., of Nieder-Marsberg, Germany, under which the English firm may make use of the Chemiebau processes for the production of sulphuric acid from hydrogen sulphide, sinter gases, sulphur, pyrites, spent oxide, gypsum, and other sulphur bearing materials in both vandium contact and 'intensive' tower type plant.

Manufacture of auxiliary and related equipment comprising: vacuum and high concentration plants, mechanical sulphate burners, rotary furnaces, reduction kilns and electrostatic filters for dust and mist precipitation is also covered by the arrangement.

The Butterley Co., Ltd., announce the following appointments to their newly-formed Oxygen Generator Division:—MR. H. W. BARNETT will be manager of the new division as well as act as the company's London manager, the post he now holds. MR. A. A. C. ROBERTSON, A.M.I.Mech.E., will be chief engineer, while DR. G. G. HASELDEN, Ph.D., D.I.C., A.M.I.Chem.E., has been appointed consultant. Purchasing agent is MR. H. P. WILLIAMS. Headquarters of the division are at 20 Ashley Place, London, S.W.1. Tel. VICTORIA 8023.

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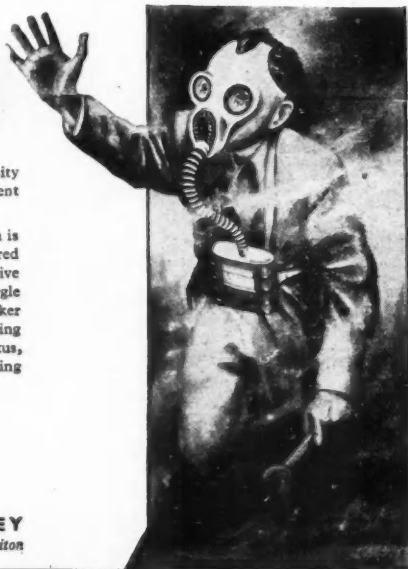
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ASSISTANT ENGINEER required by Chemical Engineering Firm in London. Qualifications required are: Age up to 30; B.Sc. or equivalent; good knowledge of physics and heat transfer essential; good mathematics; understanding of chemistry desirable; practical Works' experience essential; understanding of general office procedure and technical sales an advantage. The position offers excellent opportunities to a man having these qualifications coupled with a keen business outlook. Write stating age, qualifications, salary required to Box No. C.A. 3195, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.

CHEMISTS and PHYSICISTS required for **ATOMIC ENERGY** factories at Sellafield, Cumberland; Salwick Preston; and Capenhurst, Chester. Must have Honours Degree, A.R.I.C., A.Inst.P., or equivalent. Salary range, £406 (age 21)-£728 (age 30)-£833. Good prospects. Applications to **MINISTRY OF SUPPLY, DIVISION OF ATOMIC ENERGY (PRODUCTION)**, RISLEY, WARRINGTON, quoting 420.

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Three Steam-heated **WATER STILLs** by **MANESTY**, Type 4. Capacity, 50 g.p.h. each. Steam consumption, 667 lb. hr. at 20/45 lb. sq. in. 450 gals. cooling water required per hr.

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3—Baker Perkins and Werner Jacketed **MIXERS** screw tipping pattern, friction pulley drive, single geared, with double-fln type agitators.

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1—24 in. **HYDRO EXTRACTOR**, self balancing, swan-neck type, self emptying bottom.

Heavy **Cake CRUSHING MILL**, 2-pair high, by Nicholson, for cake up to 3 in. thick, rolls 30 in. long, top with coarse teeth 9 in. diam., bottom with finer teeth 12 in. diam.

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Bennett Copper-built **EVAPORATOR**, 4 ft. diam. by 4 ft. 6 in. high, steam-jacketed bottom, mounted on legs, with swan-neck vapour pipe and separate vertical belt-driven vacuum pump.

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VARIOUS MONO and other **PUMPS** in stock, 2 in. to 6 in. new and second-hand, in stainless steel, gunmetal and cast iron.

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Ten Welded Dish-ended **CYLINDRICAL ENCLOSED TANKS**, 7 ft. 9 in. by 6 ft. diam. 1,250 gallons each. Fitted manhole and cover, etc.

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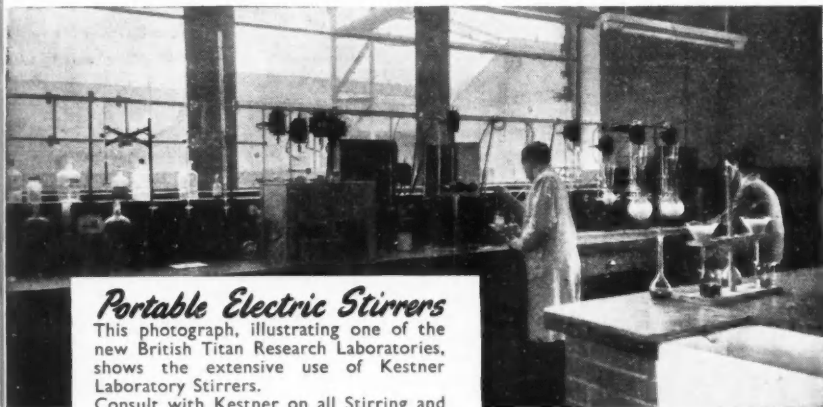
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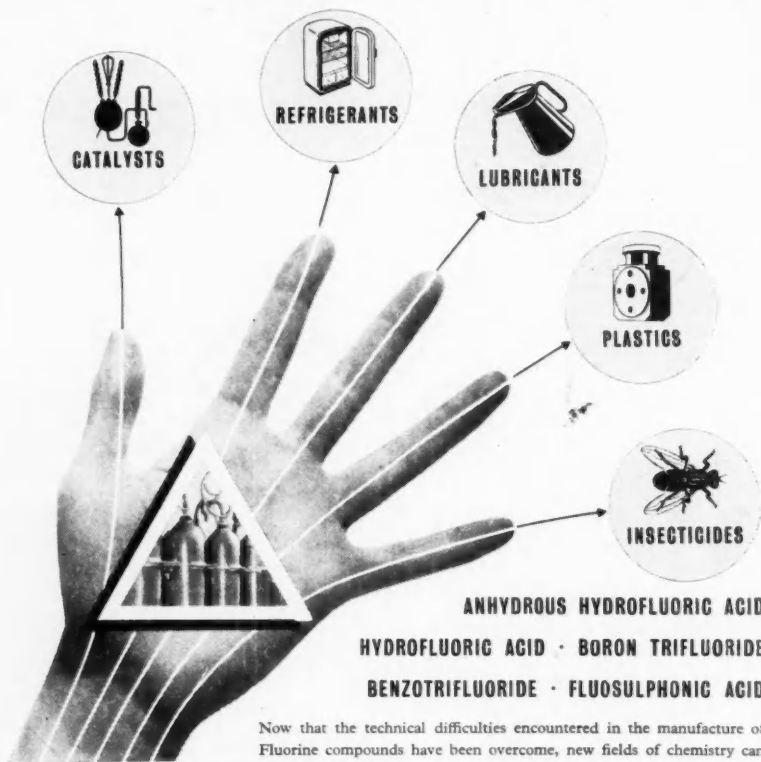
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